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BEYOND PATRIOT?

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This Thesis examines the major obstacles to development and deployment of effective U.S. Theater Missile Defense (TMD) programs. America is embarked on an aggressive TMD acquisition program with 10 TMD systems under research and development, excluding the Brilliant Eyes satellite and the Israeli Arrow.

This thesis reviews the effects of ambiguities in the 1972 Anti-Ballistic Missile (ABM) Treaty on TMD development. Current TMD programs are further evaluated to determine if they have the capability to counter strategic ballistic missiles. Other issues examined include the effects of technology advancement on the ABM treaty and TMD, funding restraints of TMD, and the implications for the global arms control structure of an abrogated ABM Treaty.

This study concludes that several of America's TMD programs under consideration are capable against strategic ballistic missiles and thereby violate the ABM Treaty.

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Theater Missile Defense: Beyond Patriot?

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ABSTRACT

This thesis examines the major obstacles to development and deployment of effective U.S. Theater Missile Defense (TMD) systems. America is embarked on an aggressive TMD acquisition program with 12 TMD systems under research and development, including the Brilliant Eyes satellite and the Israeli Arrow program.

This thesis reviews the effects of ambiguities in the 1972 Anti-Ballistic Missile (ABM) Treaty on TMD development. Current TMD programs are further evaluated to determine if they have the capability to counter strategic ballistic missiles. Other issues examined include the effects of technology advancement on the ABM treaty and TMD, funding restraints of TMD, and the implications for the global arms control structure of an abrogated ABM Treaty.

This study concludes that several of America's TMD programs under consideration are capable against strategic ballistic missiles and thereby violate the ABM Treaty.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This thesis examines the major obstacles to development and deployment of effective U.S. Theater Missile Defense (TMD) systems. America is embarked on an aggressive TMD acquisition program with at least 12 TMD systems under research and development, including the Brilliant Eyes satellite and the Israeli Arrow program.

The obstacles to this new direction in ballistic missile defense are many and give rise to a host of questions, such as: one, how ambiguous is the 1972 Anti-Ballistic Missile (ABM) Treaty in relation to TMD development and deployment? Two, do current U.S. TMD programs possess capabilities to counter strategic ballistic missiles? Three, what are the implications for the global arms control structure for an abrogated or weakened ABM Treaty? Four, are technological advances in TMD sensors, missile interceptors, radar, and external cueing available to TMD systems out-pacing the ABM Treaty? And finally, can the Department of Defense's declining budget profile support an expanding TMD program?

This thesis addresses these questions in four chapters. Chapter II reviews the ABM Treaty for current and past ambiguities that will impact U.S. plans for TMD development and deployment. This chapter also reviews the impact of treaty ambiguity on TMD development and the distinction

between TMD and ABM defensive systems. Chapter III examines current U.S. TMD systems and models their capability to counter strategic ballistic missiles in an environment subject to nuclear weapon blast effects. Chapter IV surveys the implications of a weakened or abrogated ABM Treaty on the arms control structure. Chapter V reviews prospects for the future and funding restraints to TMD development.

This thesis finds that the ABM Treaty was ambiguous when it was signed in 1972, and it is still ambiguous today. Past ambiguities applied mostly to ABM systems, but advances in missile defense technology blurred the distinction between TMD and ABM defense systems. The absence of a demarcation line in the treaty between TMD and ABM defense does not provide the proper restraint on TMD systems. This study concludes that wide-area defenses, such as the Army's Theater High Altitude Area Defense (THAAD) and Navy Upper-Tier are capable against strategic ballistic missiles and thereby violate the ABM Treaty. An ignored or ineffective ABM Treaty may lead to a weakening of the arms control structure and a halt in offensive arms reductions between the two nuclear Superpowers.

Finally, funding restraints comprise part of the policy dilemma facing the Adminstration, Congress and DOD: how to develop effective TMD in an environment of declining defense budgets and an ambiguous ABM Treaty? Although the United States has expended considerable funds on THAAD system

development, the THAAD interceptor's viability depends on the success of a recent Clinton adminstration proposal to clarify the ABM Treaty with the Russians. The ABM Treaty needs to be changed to prevent wasteful expenditure of TMD funds on systems that can not be fully tested or deployed, and to prevent unrestrained TMD development.

I. INTRODUCTION

After the Gulf War and its relentless Scud missile attacks, the United States reoriented the ballistic missile defense program to prioritize Theater Missile Defense (TMD). National missile defense of the "Star Wars" era, was reduced in funding and relegated to research only. The United states is embarked on an aggressive TMD acquisition program with 12 systems under research and development, including the Brilliant Eyes satellite and Israeli Arrow program.

America's concerted approach to effective TMD development and deployment faces at least three major obstacles: first, highly capable TMD development may lead to a violation of the ABM Treaty and needless expenditure of funds for systems that can not be deployed; second, the ABM Treaty's functional definition of an ABM system is outdated by advancements in technology; and, third, declining budget realities may limit production to two or three TMD programs.

This thesis examines U.S Theater defense Programs under consideration and evaluates major obstacles to their development and deployment. America's development and deployment of highly capable TMD systems may lead to a capability to intercept strategic, as well as theater ballistic missiles. This has serious implications for U.S. policy makers, the arms control structure, and our strategic

deterrence posture. The continued development of TMD systems that are capable of intercepting strategic ballistic missiles may lead to abrogation of the 1972 Anti-Ballistic Missile (ABM) Treaty.[1]

A. BACKGROUND

TMD was addressed only as a sideline issue during the "Star Wars" era, because the systems were perceived as "not" capable against strategic ballistic missiles. TMD system development recently gained attention, because of concern that the U.S. would deploy highly capable TMD systems that are also capable of countering strategic ballistic missiles. Although the Theater High Altitude Area Defense (THAAD) system is scheduled to begin flight tests this fall, there is still a question of whether it is compliant with the ABM Treaty.

TMD development by the United States raises many other questions, most of which remain unanswered. Key among them to be addressed in this thesis are: first, how ambiguous is the ABM Treaty in relation to TMD systems? Second, do current U.S. TMD programs possess capabilities to counter strategic ballistic missiles? Third, will the lack of a demarcation line between TMD and ABM systems in the treaty prohibit TMD systems from acquiring a capability against a

[1]Hereafter referred to as "ABM Treaty."

strategic ballistic missile? Fourth, what are the implications for the global arms control structure for an abrogated ABM Treaty? Fifth, are technological advances in TMD sensors, missile interceptors, radar, and external cueing available to TMD systems out-pacing the ABM Treaty?

B. ORGANIZATION AND METHODOLOGY

This thesis is grounded on the premise that the development of theater ballistic missile defenses is inextricably linked to strategic ballistic missile defenses, because of ambiguities in the ABM treaty. The ABM treaty will be reviewed as it applies to the distinction in the treaty between strategic ballistic missile defense and theater ballistic missile defense. This review will examine other ambiguities in the treaty that were previously thought applicable only to strategic missile defense. From a policy making perspective this analysis will demonstrate the barriers that proponents of TMD should have to overcome, since the majority of the arguments that apply to theater defenses are also applicable to strategic defenses.

Upon completion of the ABM treaty review, current TMD systems will be examined to determine whether they comply with the ABM treaty as it is interpreted by the present Presidential Administration, the arms control community, Congress, and others. General performance characteristics of each theater defense system will be discussed followed by the

use of a capability model to ascertain TMD capability to intercept a strategic ballistic missile. The model uses footprint analysis in combination with nuclear weapon blast effects to simulate the possible interaction between a TMD interceptor and a Strategic ballistic missile.

The next section of the thesis will include a discussion of the current global arms control structure as it relates to the ABM treaty. The ABM treaty will be assessed as the foundation of the Strategic Arms Limitation Talks (SALT) and the Strategic Arms Reduction Talks (START). This section will evaluate the possible effects on offensive arms control agreements caused by an abrogation of the ABM treaty.

The thesis concludes with an review of future prospects available to the United States in the arena of TMD development and deployment. Differences in the number of planned TMD systems are evaluated against budget dollars available in a declining defense posture. Is it in the U.S. interest to seek agreed-upon definition of TMD to prevent further erosion of the ABM treaty? Well thought- out policy options may prevent the needless expenditure of funds for TMD systems that cannot be deployed or fully utilized because of ABM treaty conflicts.

II. THE ABM TREATY

The ABM treaty was negotiated between the United States and the Soviet Union during 1971 and 1972; it was signed by President Nixon and Soviet General Secretary Brezhnev on May 26, 1972. The ABM treaty was considered soon thereafter by the United States Senate, which gave its advice and consent on August 3, 1972, with no reservations or conditions. The ABM treaty entered into force on October 3, 1972 and has been in effect continuously since that time.[2]

The Protocol to the ABM treaty was signed in Moscow on July 3, 1974 and entered into force on May 24, 1976.[3] The ABM treaty, together with the Protocol of 1974, further limits the United States and the Soviet Union each to one ABM deployment area, so restricted and so located that it cannot provide a nationwide ABM defense or become the basis for developing one.[4] In short, the ABM treaty provides

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[2]Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems, May 26, 1972, UST 3435, TIAS no. 7503.

[3]See the Protocol to the Treaty Between The United States of America and The Union of Soviet Socialist Republics On the Limitation of Anti-Ballistic Missile Systems, July 3, 1974, 27 UST 1645, TIAS no. 8276. Reprinted in Appendix B.

[4]ABM Treaty. Article III originally provided for two ABM deployment areas for each party to the treaty, one around the Party's national capital and one area containing ICBM silo launchers. The Protocol limit is one area for each party.

restrictions on numbers of ABM deployment areas and site locations, thereby, preventing the development of a nationwide ABM defense. Each nations retaliatory missile force remain unchallenged by strong active defenses. Article I of the ABM treaty reinforces this point:

> Each party undertakes not to deploy ABM systems for a defense of the territory of its country and not to provide a base for such a defense, and not to deploy ABM systems for defense of an individual region except as provided for in Article III of this Treaty.[5]

Each nation pledged not develop ballistic missile defenses, other than the one area allowed by the treaty, and to remain defenseless against a massive ballistic missile attack. Moreover, at the one ABM site permitted, no more than 100 interceptor missiles and 100 launchers were allowed. In addition to these quantitative restrictions, technological improvements are likewise limited; for example, both parties are prohibited from developing, testing, or deploying ABM launchers capable of launching more than one interceptor missile at a time.[6]

A. BACKGROUND OF ABM TREATY AMBIGUITIES

The ABM treaty is unclear and not well defined in relation to TMD development and deployment. Amazingly brief by today's standards, the ABM treaty consists of a Preamble and 16 Articles. The ABM treaty also includes three

[5]Ibid., Article I.

[6]Ibid., Article V.

attachments that delineate Agreed Statements, Common Understandings, and Unilateral Statements derived during the period of treaty negotiations.[7] According to John Rhinelander: "These 'Agreed Statements' and 'Common Understandings' are an integral part of the Treaty and help to clarify some elements of its text."[8] The current writer maintains that the very existence of the three attachments that originated during treaty negotiations and enclosed to further clarify the treaty, but, were not included as a part of the treaty proper, is ambiguous and provides a recipe for trouble.

One conclusion that can be drawn from a casual review of the attachments to the ABM Treaty is that the majority of the Agreed Statements, Common Understandings, Unilateral Statements, and SCC Agreements apply to the first six articles of the ABM treaty. Logical analysis would assume that the first six articles of the ABM treaty to be unambiguous since the majority of the clarifications are written against those articles.[9]

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[7]U.S. Arms Control and Disarmament Agency, Arms Control and Disarmament Agreements: Texts and Histories of Negotiations, 1982 ed., Washington, D.C., Government Printing Office, 1982, p. 137-63.

[8]John B. Rhinelander, "The ABM Treaty - Evolution and Interpretation," quoted in Hans Gunter Brauch, ed., Star Wars and European Defense, New York, St. Martin's Press, 1987, p. 384.

[9]Of course, the argument could be made that this is an expected occurrence since the greater part of the controlling articles (those articles that actually perform the functional aspects of the treaty as opposed to verification or administration) are, by design articulated in

Although the brevity of the ABM Treaty text should not be an indicator of ambiguity, the text length of the three attachments to the treaty exceeds the treaty text. Perhaps, the brevity of the articles comprising the ABM treaty is one of its greatest weaknesses. As table I indicates, treaty length has increased over the years. Comparison of the ABM

TABLE I: PAGE COUNT OF VARIOUS TREATIES

TREATY	NUMBER OF PAGES	YEAR SIGNED
ABM	6	1972
SALT I	4	1972
SALT II	32	1979
HALIBUT FISHERY	36	1979
PACIFIC SALMON	31	1985
INF	90	1987
START I	250	1991

Note: Pages counts are approximate and intended to show relative differences only. ABM (Anti-Ballistic Missile); Salt (Strategic Arms Limitation Talks); INF (Intermediate-Range and Shorter-Range Nuclear Forces (INF); START (Strategic Arms Reduction Talks).

Treaty's length to the START I Treaty illustrates more than an order-of-magnitude difference at 250 pages of text. A review of more recent arms control treaties, such as the Intermediate-Range and Shorter-Range Nuclear Forces (INF) and the START treaties, reveals that a major ABM treaty ambiguity is corrected by the simple addition of a glossary of terms.

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the first six articles. Acceptance of this argument, however, supports the basic premise that the ABM treaty is still ambiguous at best.

The ABM treaty has not been changed or updated in 12 years and it remains ambiguous in relation to TMD development. The absence of detail and what the treaty does not say is probably its most egregious fault.

B. CURRENT TREATY AMBIGUITIES

This section will demonstrate that the evaluation of TMD compliance with the ABM treaty is unclear in many areas of the treaty previous thought to apply only to ABM defense. Advancements in missile defense technology have greatly improved TMD capability to the point where the distinction between theater and ABM defenses is less clear. This section will also show that the treaty is still ambiguous in the same areas supposedly clarified by attachments to the treaty, in 1972.

The post Cold War environment is producing pressure to revise the ABM treaty and thereby relieve some of the ambiguities related to the lack of distinction between TMD and ABM defenses in the treaty. The memory of the Gulf War and the relentless Scud missile attacks intensified the need for a more efficacious missile defense system. Although America and her allies were thankful for the improved protection and morale engendered by the Patriot Missile Defense batteries, the final result of the Patriot may have

been more political than military.[10] The resulting drive by the United States and other developed nations, to develop and deploy TMDs that are appropriate for the projected ballistic missile threat, is the engine that drives the ABM debate.

Several authors have examined TMD in the proper perspective as it relates to the ABM treaty; that is, the current and past ambiguities in the ABM treaty are just as critical to TMD and the so-called "SAM Upgrade" problem, as they are, to ABM defenses.[11] Theater defenses and strategic defenses do not exist in separate vacuums and should be addressed in an interrelated context due to improved performance, both, in ballistic missiles and in ballistic missile defenses. The following sections will address the major ambiguities of the ABM Treaty as they relate to TMD.

1. Not to Provide a Base For Defense of Territory

The Preamble succinctly lays the groundwork for the fundamental objective of the ABM treaty which is to limit the development and deployment of ABM systems:

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[10]Most critics acknowledge that the deployment of the Patriot kept the Israelis from entering the war and destroying the allied coalition, but the military effectiveness of the Patriot was questioned. See John Conyers Jr., "The Patriot Myth: Caveat Emptor," Arms Control Today, November 1992, P. 3; and, Andrew W. Hull "Motivations for Producing Ballistic Missiles and Satellite Launch Vehicles," Jane's Intelligence Review, February 1993, p. 86.

[11]See Brian D. Dailey and Patrick J. Parker, eds., Soviet Strategic Deception, Hoover Institution Press, Lexington, Mass., 1987, p. 226-251; and, Herbert Lin, New Weapon Technologies & the ABM Treaty, Pergamon-Brassey's International Defense Publishers, Mclean, VA., 1988, p. xiii-xviii.

> Considering that effective measures to limit anti-ballistic missile systems would be substantial factor in curbing the race in strategic offensive arms and would lead to a decrease in the risk of outbreak of war involving nuclear weapons....[12]

Article I (2) of the ABM treaty codifies the agreement by the United States and the Soviet Union to not to deploy strategic defenses:

> Each Party undertakes not to deploy ABM systems for a defense of the territory of its country and ***not to provide a base for such a defense*** [emphasis added], and not to deploy ABM Systems for defense of an individual region except as provided for in Article III of this Treaty.

In short, each Party to the ABM treaty ostensibly subscribed to the hostage view of nuclear war known as the doctrine of Mutual Assured Destruction (MAD)[13] and promised to remain defenseless against nuclear attack via ballistic missiles. So, the possibility of one party to the ABM treaty contemplating a so-called breakout of the treaty, was a consistent debate throughout the 1970s and 1980s. The words above, from Article I of the ABM treaty, are just one of the many ambiguous phrases that have never been defined or agreed to, by the United States and the Soviet Union. What do the

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[12]The ABM Treaty (Preamble).

[13]For an opposing viewpoint, see Dailey and Parker, eds., Soviet Strategic Deception, p. 226-7. Brian Dailey skillfully argues in Chapter 11 that the Soviets used deception to convince the United States that they (the Soviets) accepted MAD: "In short, the bases on which the Soviets entered the negotiations were to, first, mask their objective of stopping or significantly curtailing the U.S. ABM research to buy time for the Soviet active defense program, and second, after 1972, to adjust the deception to reinforce Western perceptions and predilections of Soviet military strategy as a solely assured-destruction policy.

words "provide a base for a nationwide defense of territory" actually mean in terms of ABM defenses, and, more importantly what do they mean in regard to TMD?

Agreed Statement (C) to the ABM treaty attempted to strengthen the intent of Article (I) to "not provide a base," by mandating: "...the center of the ABM system deployment area centered on the national capital and the center of the ABM system deployment area containing ICBM silo launchers for each Party shall be separated by no less than thirteen hundred kilometers." The New World Dictionary defines "base" as: "the thing or part on which something rests"; "lowest part or bottom"; "foundation."[14] The apparent difficulty with defining the term "base" lies in selecting or identifying *that thing or part* which forms the foundation for a nationwide defense of territory.

Many parts or components of TMD could be perceived as providing a base for a nationwide defense of territory described in Article I of the treaty. Major items that are used for TMD, but could ostensibly be used to provide a base for expansion of TMD to a nationwide ABM defense include: (1) Large Phased-Array Radar (LPAR); (2) Aegis Cruisers with missiles capable of exoatmospheric intercept; (3) Sam Upgrade Problem; (4) Brilliant Eyes satellite; (5) Boost Phase Intercept; (6) Airborne and Interceptor Sensors.

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[14]Webster's New World Dictionary, 2nd College ed., s.v. "Base."

a. Large Phased-Array Radars and TMD

Large ABM radars are considered the verifiable element of the "base" for a ballistic missile defense of territory. LPARs are examined in relation to TMD because of the possibility that unrestrained development and deployment of theater defense radar may be perceived as a violation of the ABM treaty. Gerard Smith suggested that "the warning time given by a Soviet start of construction of radars of the LPAR type would be long enough to permit extensive countermeasures such as the development and initial deployment of wholly new offensive missile systems."[15] Consequently, the LPARs were considered the critical guiding eyes of ABM systems, and the "long-lead-time item" of a nationwide defense.[16]

The ambiguity in LPARs construction and operation occurs because the ABM treaty allows radars for early warning (Article VI)[17], space tracking, National Technical Means (NTM) and LPARs. These radars are all very similar in appearance and function. Significant confusion results in distinguishing the very similar LPARs from a Ballistic Missile Early Warning

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[15]Gerard Smith, Double Talk, p. 303.

[16]Matthew Bunn, Foundation for the Future: The ABM Treaty and National Security, The Arms Control Association, Wash, D.C., 1990, p. 108.

[17]The ABM Treaty, Article VI. The article stipulates "not to deploy in the future radars for early warning of strategic ballistic missile attack except at locations along the periphery of its national territory and oriented outward.

(BMEW) radar and the LPARs used for space tracking and verification by NTM.[18] The United States and the Soviet Union made serious charges and counter charges about the Krasnoyarsk radar[19] (challenged as an ABM facility) and the Thule/Fylingdales upgrade (challenged as an ABM facility). The Soviets initially claimed Krasnoyarsk was a space tracking radar, but later agreed that Krasnoyarsk was a violation of the ABM treaty.[20]

The differences in function between LPARs and TMD radars are many (e.g., size, frequency, hardness, range, etc.), but the effect of unlimited TMD radar deployment may be the same--a perceived notion of a breakout from the ABM treaty. Critics of the Soviet Mobile ABM-X-3 and SA-12 have pointed out that these systems could be effective against U.S. strategic warheads, particularly SLBM warheads, if they were netted with ABM radars.[21] The THAAD TMD Ground-Based-

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[18]The ABM Treaty, Agreed Statement (F). This agreement also limits deployed phased-array raiders to a potential (the product of mean emitted power in watts and antenna in square meters) of three million watts/meter squared except where permitted elsewhere in the treaty and NTM or space tracking.

[19]Report to Congress on the Strategic Defense Initiative, Washington, D.C., Department of Defense, 1989, 1-5.

[20]Matthew Bunn, Foundation for the Future, p. 101.

[21]The ABM or other long range radar could hand over tracking information, "tipping off" the short range TMD radar that a target was on the way and where to look for it. See Simon P. Worden, SDI and the Alternatives, National Defense University Press, Washington, D.C., 1991, p. 152; Department of Defense, Soviet Military Power, Government Printing Office, Washington, D.C., 1982, p. 28; and, Jack Anderson, "Soviet Missile May Be Peril to US Weapon," Washington Post, April 5

Radar (TMD-GBR) is designed to be externally cued by satellites such as Brilliant Eyes.[22] The argument could be made that external cueing of the TMD-GBR is analogous to the U.S. complaint of Soviet netting of the SA-12 TMD system to ABM radars. There is no evidence that the Russians have made this argument, but the logic is clear. Developing policy options after hardware is already built, is normally an unwise expenditure of funds.

Range capability of TMD radar is primarily dependent on output power. Agreed Statement (F) of the ABM treaty specifically limits output potential (usually expressed in "power aperture product) of ABM radars to three million watt-meters squared,[23] but the potential of theater defensive radar is not regulated. Obviously, the mobility of theater systems is constrained by the size and power of the antenna, but without power aperture product restrictions significant range capability is still possible. For example, during the Gulf War, Aegis ships--the cruiser "Mobile Bay" and others--tracked scuds from hundreds of miles

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1983, p. C15. For an opposing viewpoint see Hans Gunter Brauch, ed., Star Wars and European Defence, p. 510.

[22]Interview between William Loomis, Vice-President, Defensive Missile Systems, Lockheed Missiles & Space Co., Sunnyvale, CA., and the author, 29 April 1994; see also Barbara Opall, "Strategic Accord Inhibits Advances In TMD Programs," Defense News, 4 October 1994, p. 1.

[23]"Power aperture product" is the product of mean emitted power in watts and antenna area in square meters.

away with the precision required to support intercepts.[24] The Theater High Altitude Area Defense (THAAD) system, currently in development by the US Army, reportedly has a nominal detection range of about 500 kilometers.[25] On the other hand, the Patriot system radar is not nearly as capable with only a few tens of kilometers range against a low radar cross-section target. The differences in range between the Patriot and THAAD systems depend on many other factors besides power aperture product, but all other factors being equal, the power aperture product of the Patriot radar is estimated at 100,000 watt-meters squared--significantly less than THAAD.[26]

The development of the THAAD system is *prima facie evidence* of how improvements, in power aperture product of TMD radar along with concomitant interceptor enhancements, can dramatically increase range and capability.[27] The power aperture product of the THAAD system

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[24]John E. Carey, "Fielding a Theater Ballistic Missile Defense," Proceedings, June 1993, p. 56.

[25]For an excellent examination of the range determinate factors of theater defenses, including type and nature of the assumed target, see Lisbeth Gronlund and others, "Highly Capable Theater Missile Defenses And the ABM Treaty," Arms Control Today, April 1994, p. 3-8.

[26]Herbert Lin, New Weapon Technologies, p. 48.

[27]The published intercept range for THAAD is approximately 160 km, which suggest a conservative detection range of at least 300 km for the projected theater threat. See Clifford Beal, "Racing to Meet the Ballistic Missile Threat," International Defense Review, March 1993, p. 209.

radar is estimated at roughly 500,000 watt-meters squared.[28] With an estimated expansion of five to six times the current TMD radar power before treaty limits are reached, concurrent improvements in interceptors could, at least, double the nominal range to 1000 km--all other factors equal. This type of development, could lead to the greatest threat to the viability of the ABM treaty.

b. Navy Upper-Tier

Theater defenses use phased-array radars that are mobile land-based or sea-based, and rapidly deployable--all features are specifically prohibited by the ABM treaty. Article V of the ABM treaty is clear:

> Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based.[29]

Any future TMDs will possess all of these features but ***none*** of these capabilities are limited or even mentioned by the ABM treaty in regard to TMD. Therein lies the TMD-ABM interoperability problem and possible use in a "base" for a nationwide defense. The numbers and specific deployment locations of TMD systems are not regulated at all.

As TMD systems improve in range and capability to intercept strategic missiles, their perceived use to fill gaps

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[28]The actual figure is classified, but industry officials report the number to be less than one million watts-meter squared--at most less than one third of the ABM treaty limits. Interview between William Loomis, vice president for defensive missile systems at Lockheed Missiles & Space Co., Sunnyvale, CA., and the author, 29 April 1994.

[29]ABM Treaty Article V.

in existing ballistic missile early warning coverage or to provide a strategic defense may be contemplated. Two recent examples of perceived strategic use of the Navy upper-tier theater defense system illustrate this point perfectly: (1) Admiral Kelso (The former Chief of Naval Operations) was quoted in the New York Times of August, 1993 as saying: "we could take a fleet of Aegis cruisers off the East coast of the United States and provide missile defense of the United States"; (2) not surprisingly, the essence of that statement was repeated by Admiral William D. Smith on November 3, 1993:

> We could take a small number of Aegis cruisers stationed off the East Coast of the United States and provide missile defense of the United States.[30]

Clearly, the Aegis cruisers are viewed by proponents as a means to provide a "base" for expansion to a nationwide ABM system.

If the U.S. does not control the number of systems and how we deploy them, the viability of the ABM treaty will be threatened.[31] Recent TMD talks between France and the United States reportedly used simulations in which just two Aegis cruisers in the Western Mediterranean, armed

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[30]William D. Smith, "Forum on Theater Ballistic Missile Defense," hosted at the Naval Postgraduate School, Monterey, CA., 3 November 1993.

[31]This assumes that the Aegis cruisers will have capability to intercept not just theater ballistic missiles, but strategic ballistic missiles as well. This is probably a valid assumption if the Aegis cruisers are given exoatmospheric intercept capability.

with Standard Block IV-A missiles with LEAP[32] seekers and working with a Cobra Judy phased-array radar on Corsica, demonstrated their ability to protect from missile attack an area extending from Rome to London.[33] Without question a sea-based exoatmospheric TMD system, with capability to intercept a strategic ballistic missile, will violate the ABM treaty by providing a "base" for nationwide defense of U.S. territory. John Pike also sees the exoatmospheric Aegis cruiser as a major problem for the ABM treaty:

> If the Navy's system is permitted under the treaty, all the United States would have to do to very rapidly get a nationwide system, would be to have the all the Ticonderoga Aegis cruisers come back to home port and ring the country with these interceptors. From the standpoint of being able to very rapidly break out of the treaty, in the long run the SM-2 LEAP is probably going to be of far greater concern than THAAD.[34]

The funding of the upper-tier defense for the Aegis cruiser has been reduced by the Ballistic Missile Defense Organization (BMDO) for its FY95 budget request

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[32]The Standard Missile Block IV-A with LEAP (Lightweight Exo-Atmospheric Projectile) is planned as the Navy's so-called upper-tier theater defense system. The intercept range is projected to be slightly better than THAAD. See Barbara Starr and John Boatman, "US Navy gets into Theater Missile Defense," International Defense Review, June 1993, p. 468.

[33]Nick Cook, "France, USA Lead the Way With TMD Talks," Jane's Defence Weekly, 19 March 94, p. 1.

[34]John Pike, "A New Threat to the ABM Treaty: The Administration's TMD proposal," Arms Control Today, January/February 1994, P. 16.

c. SAM Upgrade Problem

Surface-To-Air (SAM) Upgrade is a controversial issue that encompasses the essence of the ABM treaty's prohibition against providing a base for a defense of territory. The "SAM upgrade" problem started in the mid 1960s when the Soviet Union installed a high-performance air-defense system based on the SA-5 missile. The system was called the "Tallinn" system--after the name of the Estonian city where the SAM components were first observed.

With the advent of the Soviet Galosh ABM missile, Americans began to fear that the Tallinn system might be designed for defense against missiles or, at the least, to serve a dual purpose.[35] The SA-5s were believed to be part of an ABM network because the location of the system coincided with the potential flight paths of incoming American missiles. The so-called "Tallinn" line formed a defensive barrier that was part of the Soviet's extensive air-defense network. With the eventual installation of some 9,000 SAM launchers, 2,000 interceptor aircraft, and 10,000 air-defense radars, the fear that the these air-defense components could be upgraded to a nationwide ABM system became part of the ABM Treaty negotiations.[36]

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[35]John Newhouse, Cold Dawn: The Story of SALT, Holt Rinehart and Winston, New York, 1973, p. 11.

[36]Matthew Bunn, The ABM Treaty, p. 49. See also Gerard Smith, Double Talk, p. 95.

The name "SAM Upgrade" has persisted, even today, as shorthand for those air-defense and TMD systems that are exempt from the ABM Treaty. Article VI (a) of the ABM Treaty codifies the prohibition on upgrading non ABM systems or components:

> Each Party undertakes not to give missiles, launchers, or radars, other than ABM interceptor missiles, ABM launchers, or ABM radars, capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and not to test them in an ABM mode.

The "SAM Upgrade" issue received considerable attention during the SALT I negotiations and throughout the 1970s and 80s. Today the main focus of the issue is on upgrading the capability of TMDs to intercept strategic ballistic missiles. The United States recently made a proposal via the SCC to define a demarcation line between strategic ABMs and TMDs; the Russians were reportedly cool to the proposal due to its lack of comprehensiveness and undefined technical criteria.[37] By all accounts this debate will continue throughout the 1990's.

d. Brilliant Eyes

Do space-based sensors such as the Brilliant Eyes (BE) and the Defense Support Satellites (DSP) violate the ABM Treaty because vital cueing[38] information can be passed on to

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[37]See Dunbar Lockwood, "U.S. Proposal to Retool ABM Treaty Reopens Debate on Missile Defense," Arms Control Today, January/February 1994, p. 24; and, Theresa Hitchens and Barbara Opall, "THAAD May Be Treaty Debate Fulcrum," Defense News, April 11 1994, p. 1.

[38]Cueing is one sensor telling another where to look. It greatly reduces reaction time by allowing the receiving system to concentrate

ground-based theater systems? Do these systems so greatly extend the range of TMDs that it gives them ABM capability? The Strategic Defense Initiative Organization (SDIO) affirmed that cueing supplied by BEs satellites to THAAD and Navy interceptors could increase the defended footprint area by a factor of 10 from that provided by local radar support alone.[39] Valid questions about development, deployment, and the ABM Treaty, still remain to be answered even after some TMD systems are already entering the demonstration and evaluation phase.[40] It appears that the United States continues to build TMD capability beyond needs, but yet restrict its use. For example, the THAAD system has an interface to external cueing and specifically for the BE satellite.[41] Yet, the Department of Defense reportedly found the THAAD system compliant with the ABM Treaty provided the system does not use the planned Brilliant Eyes satellite.[42]

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more power in a significantly reduced search area; this effectively increases the range of the system.

[39]Report to Congress on the Strategic Defense Initiative, Strategic Defense Initiative Organization (SDIO), Washington, D.C., 1993, p. A-18.

[40]Interview between William Loomis, Vice-President for Defensive Missile Systems, Lockheed Missiles & Space Co., Sunnyvale, CA., and the author, 29 April, 1994. Mr. Loomis confirmed that THAAD completed final design review in November. The Demonstration/Validation phase begins in the fall of 1994 with a series of 20 test launches.

[41]Ibid.

[42]Barbara Opall, "Strategic Accord Inhibits Advances In TMD Programs," Defense News, 4 October 1993, p. 1.

Clearly, the Patriot missile batteries needed external cueing by the DSP satellites to provide adequate alerting and precise impact prediction during the Gulf War. Some critics claim that the external cueing provided by the DSP satellites was inadequate, because the system was not designed for short range missiles. Consequently, new satellite coverage is needed for future theater systems.[43] It appears, from the THAAD and Brilliant Eyes situation, that, if TMD satellite cueing is to be compliant with the ABM Treaty, then compliance may depend on the range of the TMD system. A tenfold increase in footprint coverage[44] for a lower-tier system such as Patriot would be significant, yet possibly non-threatening; but, the same increase in an upper tier system such as THAAD would reasonably stretch the boundary between ABM and TMD capability.

e. Boost Phase Intercept

The ultimate goal of any defense against ballistic missiles would be destruction of the enemy missile before it leaves the launcher. Short of that, the next best

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[43]Theresa Foley, "DSP Advocates, Foes Cite Dhahran Scud Attack," Space News, 18 April 1994, p. 4. DSP's ability to provide details on tactical missiles is a subject of debate. The tactical missiles burn more quickly and less brightly than the strategic missiles DSP was designed to detect.

[44]This projection uses the conservative estimate by Hertbert Lin that assumes a single stage interceptor, such as Patriot can enforce a keepout zone of approximately 10 km radius. See Herbert Lin, New Weapon Technologies, p. 74-78. The current writer assumes an approximate THAAD footprint of 60-112 km, based on an advertised intercept range of 160 km and reentry angle of 22-45 degrees.

thing is Boost Phase Intercept (BPI). The missile is destroyed shortly after takeoff before it dispenses its deadly warheads (in the case of MIRV[45]) and while its still in the highly vulnerable boost phase. Additionally, the missile emits a large Infra-red (IR) and light signature that is easily detectable by satellite or airborne platforms.

The problem with BPI systems is that if they have the capability of intercepting a theater ballistic in the boost phase, then they also can intercept a strategic ballistic missile in the boost phase. BPI systems are probably the *sine qao non* for providing a base for territorial defense. The BMDO's 1995-1999 budget request increased the funding profile, assigned to BPI, from less than $100 million to $500 million through 1999--for a system that clearly violates the ABM Treaty.[46]

f. Airborne and Interceptor Sensors

Can a Satellite or airborne mounted IR sensor serve the same function as a phased-array radar for a theater or strategic defensive missile system? Some 200 Brilliant Eyes satellites were envisioned for the Bush Administration's Global Protection Against Limited Strikes (GPALS) system to

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[45](MIRV)Multiple Independently-Targeted Reentry Vehicles.

[46]Robert Holzer and Barbara Opall, "U.S. Navy Fights BMDO for Antimissile Funds," Defense News, 11 April 1994, p. 8. The Navy's sea-based upper-tier (Aegis SM-2 LEAP) system was reduced in funding from $600 to $157 Million and downgraded to a demonstration effort over the same period.

provide early warning and targeting information needed for missile defense.[47] With today's technology, satellites (e.g. DSP or Brilliant Eyes) or aircraft mounted IRST (Infrared Search and Track) sensors can easily form part of a missile defense network and theater defense system if so designed.

Even some ABM proponents reluctantly acknowledge, that a reasonable argument can be made that the use of DSP-like[48] satellites to cue TMD systems probably violates the ABM Treaty.[49] Do the same ABM Treaty restrictions apply because the IR system is passive? Herbert Lin suggest that cueing systems, whether they are long-range active or passive, are unable to provide information precise enough to guide an interceptor missile from launch to kill.[50] This assessment is not entirely correct today, because it ignores the basing mode of the interceptor, battle management efforts, and advances in hit-to-kill technology. For example: (1) Joint Task Force 95 (JTF), scheduled later this year, will test the

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[47]Baker Spring, "For Strategic Defense: A New Strategy for the New Global Situation," The Heritage Foundation Backgrounder, 18 April 1991, p. 6.

[48]DSP-like refers to those early warning types of satellites that provide target trajectory information and impact point prediction.

[49]Interview between Baker Spring, The Heritage Foundation, Washington, D.C., and the author, 17 May 94. This statement was made in the context that DSP satellites used in combination with TMDs present a more reasonable argument for a violation of the ABM Treaty, than defining the line between TMDs and ABMs.

[50]Herbert Lin, New Weapon Technologies, p. 17. He further asserts that the information these cueing sensors provide can be passed to the sensors of the TMD system telling the sensors where to look.

so-called Cooperative Engagement Capability in which four ships will test the ability to engage a target held by another platform's sensors;[51] and, (2) the BMDO is evaluating BPI concepts that use Unmanned Aerial Vehicles (UAVs) equipped with lightweight IR sensors (for target detection and tracking) in combination with upward looking tracking cameras (to provide trajectory information) to fighters or bombers.[52] The premise that IR or other passive sensors, such as optical, used alone cannot result in a successful theater intercept appears doubtful, because of hit-to-kill technology and missile mounted sensors. The IR sensor problem is one that is not easily answered, but needs to be addressed in future policy decisions.

Interceptor Mounted Sensors (IMS) such as IR, optical, radar, and ladar[53] present an additional ambiguity in the technological incrementalism of ballistic missile defense. Does the introduction of IMS to the equation of theater defenses enhance the footprint size of the defended

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[51]Barbara Starr, "Navy TMD Waits for Funding," Jane's Defense Weekly, 12 March 1994, p. 20.

[52]"US Evaluates Candidates for TBM Boost-Phase Intercept," International Defense Review, November 1993, p. 850. This article further asserts that the UAVs will exchange fire-control information with other vehicles in the formation to provide three-dimensional track data.

[53]Ibid., p. 851. Ladar is an acronym for [Laser Radar] employed in the terminal phase of the LEAP technology interceptor. See above note 32; also see the Report to Congress on the Strategic Defense Initiative, Strategic Defense Initiative Organization (SDIO), Washington, D.C., 1993, p. A-2.

area? What is range of IMSs, and, can they be electronically steered? Can the use of IMS somehow be perceived as providing a base for a nationwide defense of territory? The use of IMS is probably a precedent for ballistic missile defense, but the concept of IMS to provide terminal guidance to an interceptor as it closes its target has been used for decades.[54]

From the perspective of TMD, the concept of IMS may become a problem when used in combination with intercepts performed during the boost phase. For example both THAAD and ERINT (Extended Range Interceptor) use hit to kill technology employing inertially guided interceptors. TMDs that use inertially guided interceptors equipped with IMS, in concert with airborne search and track sensors, may eliminate the need for a ground based radar. Moreover, as the range of the IMS improves beyond the range of terminal guidance, then the trajectory and impact point prediction of the airborne sensor will be less critical. This concept might allow an airborne asset to control truck mounted interceptors such as ERINT or THAAD without the telltale radar. It would use a system similar to BPI, except that it could be used in a terminal defense mode, but the interceptors would not have to be ground mounted. This scenario might provide a clandestine base for nationwide defenses in violation of the ABM Treaty.

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[54]Herbert Lin, New Weapon Technologies, p. 23.

2. ABM System Defined?

Article I of the ABM Treaty ensures that both parties undertake not to develop a nationwide missile defense nor provide a base for the development of a nationwide defense. Perhaps, Article II has been one of the most controversial articles because of its association with the so-called "broad" interpretation of the ABM Treaty. Clearly, an article whose sole function is to *define the ABM systems*, that are prohibited from providing a nationwide defense by Article I, should be without ambiguity. The ambiguous elements of Article II are underlined for emphasis:

> 1. For the purpose of this Treaty an ABM system is a system to **counter strategic ballistic missiles** or their elements in flight trajectory, **currently consisting of**:
> (a) ABM interceptor missiles, which are interceptor missiles constructed and deployed for an ABM role, or of a type **tested in an ABM mode**;
> (b) ABM launchers, which are launchers constructed and deployed for launching ABM interceptor missiles; and
> (c) ABM radars, which are radars constructed and deployed for ABM role, or of a type **tested in an ABM mode**.
>
> 2. The ABM systems components listed in paragraph 1 of this Article include those which are:
> (a) operational;
> (b) under construction;
> (c) undergoing testing;
> (d) undergoing overhaul, repair or conversion;
> (e) mothballed.

In short, Article II attempts to define what an ABM system is by using a functional definition. The ambiguities are: (1) failure to define a strategic ballistic missile; (2) whether "currently consisting of" is a function or a

limitation; and, (3) the definition of "tested in ABM mode." The ambiguities will be each addressed in the following sections, with the exception of number one, which will be examined under Article VI.

a. Currently Consisting Of

Article II of the ABM Treaty describes an ABM system as "currently consisting of ABM interceptor missiles, ABM launchers, and ABM radars." It should be noted that the Reagan Administration's so-called "broad" interpretation of the ABM Treaty was the only real challenge to the proper meaning of Article II and others. However, Reagan's challenge to the Treaty may be an onerous legacy, because one of the first things that President Clinton accomplished, upon assuming office, was to denounce the "broad" interpretation and to take measures to strengthen the ABM Treaty.[55] He concomitantly affirmed adherence to the "narrow" interpretation of the Treaty while emphasizing ground-based theater defenses and relegating "Star Wars" to research only.

The "broad" interpretation of the ABM Treaty originated on October 6, 1985. The then national security adviser, Robert McFarlane, during an appearance on "Meet the Press," casually indicated that the Reagan administration had

[55]Elizabeth A. Palmer, "Clinton Hews to Narrow View On ABM Treaty," Congressional Quarterly, 17 July 1993, p. 1894. See also Barbara Opall, "ABM Policy Shifts Imperil Clinton's Military Strategy," Defense News, 4 October 1993, p. 28.

redefined a key obligation of the ABM Treaty. MaFarlane declared "that testing and development of ABM systems based on 'new physical concepts' was 'approved and authorized by the [ABM] treaty'."[56] The Reagan administration subsequently argued that the ABM Treaty allowed testing and development of so-called "exotic" ABM systems and components that were not deployed when the Treaty was signed in 1972.[57] The traditional or "narrow" interpretation of the ABM Treaty affirmed that only immobile, ground-based ABM systems or components--allowed by Article III--could be developed and tested.

The Reagan Administration arrived at the broad interpretation by attempting to show that the phrase [currently consisting of: ABM interceptor missiles, ABM launchers, and ABM Radars] should be interpreted to mean those ABM missiles, launchers, and radars *currently* available in 1972 only. Reagan's legal advisor, Abraham Sofaer asserted that Article II is not a functional definition of an ABM system but rather is a precise definition of what elements the Treaty is intended to cover.[58] Since only

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[56]Raymond L. Garthoff, Policy Versus the Law: The Reinterpretation of the ABM Treaty, The Brookings Institute, Washington, D.C., 1987, p. 2-3.

[57]"The ABM Treaty Controversy," Congressional Digest, November 1987, p. 264.

[58]William J. Durch, The ABM Treaty and Western Security, p. 60.

launchers, interceptors, and radars are named, only those components are constrained and thus exotics could be tested.[59]

Ignoring the comma preceding the word *currently*, which would make the ABM components only illustrative instead of limited, Sofaer proposed to modify the phrase ",currently consisting of" by removing the comma and inserting "and."[60]

Whenever ABM opponents have tried to reinterpret the ABM treaty in the past, the approach used is to take one or more articles out of context. "Each of the substantive articles of the accord is key to the whole for each is carefully designed to block a potential avenue or circumvention."[61]

b. Tested in an ABM Mode

The phrase "tested in an ABM mode" is ambiguous because it is not defined in the ABM Treaty proper. It is particularly relevant to TMD because it is the principal means by which non-ABM systems are prevented from attaining prohibited ABM capability. The phrase is prohibitive because it identifies any items as ABM components (other than those currently consisting of), if they are "tested in an ABM mode." Article VI further supports Article II by affirming

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[59]Ibid. Sofaer claimed that no part of the Treaty proper referred to exotics. Only Agreed Statement (D) referred to "future" and to "other physical Principles," therefore the restrictions of Articles I, II, III, V, and VI only applied to those systems currently available in 1972.

[60]Raymond L. Garthoff, Policy Versus the Law, p. 25.

[61]Matthew Bunn, Foundation for the Future, p. 20.

not to test non-ABM systems or components in an ABM mode. The clarity of the phrase "tested in an ABM mode" is further clouded by the lack of a definition of strategic ballistic missile. If the definition of an ABM defense is dependent upon the functional description of a "system to counter a undefined strategic ballistic missile," then when does the "tested in an ABM mode" restriction apply to a TMD system? These and other unanswered questions are more relevant today, because as TMD capability approaches that of an ABM system, testing restrictions may inhibit the confidence in, and efficacy of, deployed TMD systems.

The "SAM upgrade" problem and Ballistic Missile Early Warning (BMEW) radar was specifically identified as vulnerable to testing in an ABM mode. Thus the United States insisted on the inclusion of a provision in the treaty that prohibited the sides from giving non-ABM missiles, launchers, or radars ABM capabilities or testing them "in an ABM mode."[62] The U.S. delegation made a statement (Unilateral Statement B) describing events that would in its view constitute testing in an ABM mode:

> (1) A launcher is used to launch an ABM interceptor missile; (2) an interceptor missile is flight tested against a target vehicle which has a flight trajectory with characteristics of a strategic ballistic missile flight trajectory, or is flight tested in conjunction with the test of an ABM interceptor missile or an ABM

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[62]Ashton B. Carter and David N. Schwartz, Ballistic Missile Defense, p. 230.

> radar at the same test range, or is flight tested to altitude inconsistent with interception of targets against which air defenses are deployed; (3) a radar makes measurements on a cooperative target vehicle of the kind referred to in item (2) above during the reentry portion of its trajectory or makes measurements in conjunction with the test of an ABM interceptor missile or an ABM radar at the same test range.

There is evidence that the Soviets did not want a precise definition of the term "tested in an ABM mode" and, in fact, Soviet insistence on ambiguous language forced the United States to make the above Unilateral Statement.[63]

Dailey also presents strong evidence that the U.S. initial concern about clarification of "tested in an ABM mode" was valid due to numerous Soviet violations as follows: (1) testing of SAM interceptors and radars against reentry vehicles; (2) netting of various SAM and ABM radars; and, (3) ABM Treaty radar violation issues.[64] An Agreed Statement of the SCC, in 1978, further refined the term "tested in an ABM mode" and regulated other operations of air-defense radars at ABM test ranges providing in part:

> ...is considered to be 'tested in an ABM mode' if it performs certain functions such as tracking and guiding an ABM interceptor missile or tracking strategic ballistic missiles or their elements in flight trajectory in conjunction with an ABM radar which is tracking and guiding an ABM interceptor missile...Tracking alone is insufficient for a radar to be tested in an ABM mode; the

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[63]Brian D. Dailey and Patrick J. Parker, Soviet Strategic Deception, p. 249.

[64]Ibid., 234-37.

presence of an ABM interceptor being guided by an ABM radar is also required.[65]

It is ironic that the same netting of theater defense radars with satellites and aircraft today by the United States is not addressed by the Russians.

Finally, Article VI of the ABM Treaty has been said to have a double test: it prohibits giving non-ABM systems the capabilities to counter strategic systems, and the sides are not allowed to "test them in an ABM Mode."[66] The Clinton Administration's recent TMD proposal to the SCC to modify Article VI of the ABM Treaty, would permit development of TMD systems if they did not have a "demonstrated" capability against a strategic ballistic missile. John Rhinelander asserts that, if this proposal is accepted, "it will force us to single standard where testing is the only real restriction."[67]

3. ABM Component Defined?

Article III of the ABM Treaty delineates the specifics of the one ABM site that is allowed. The site must be within a deployment area having a radius of 150 km and

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[65]Matthew Bunn, Foundation for the Future, p. 81. For further refinements on a "reverse-boosted" target, also see Herbert Lin, New Weapon Technologies, p. 36.

[66]John Rhinelander, "A New Threat to the ABM Treaty: The Administration's TMD Proposal," Arms Control Today, January/February 1994, p. 14.

[67]Ibid. Rhinelander further asserts "that's exactly what we avoided for good reasons during SALT I negotiations.

centered on the Party's national capital or within a deployment area (also 150 km radius) containing ICBM silo launchers. ABM components are limited to no more than 100 launchers and 100 interceptor missiles at each site; LPARs and ABM radars are also limited. The opening statement of Article III contains the ambiguity: Each Party undertakes not to deploy ABM systems or their components except within the allowed single site. The "broad" interpretation also relied on this article for support of its assertion that the components represented only those components available in 1972.

What is the definition of an ABM component? As defined by Article II, components are ABM interceptors, launchers, and radars constructed and deployed for an ABM role, or tested in an ABM mode. The ambiguities represented by the phrase "tested in an ABM mode," not withstanding," the Article II definition is clouded further by Agreed Statement (D), which includes components capable of substituting for ABM interceptor missiles, launchers or Radar in the future. The question becomes whether "component" is an element that is capable of performing the function of an ABM component, and also, when in the development process does the designated element become an ABM component. Recent scholars cite the difference between a component and an adjunct which would not

be limited by the Treaty.[68] An "adjunct" being a system to help an ABM system function, without being critical and unable to substitute for an ABM component. An example would be a small optical telescope used in conjunction with an ABM radar for calibration.[69]

The airborne AWACs or Brilliant Eyes satellite probably crosses the line of being an ABM component considering that they can direct airborne or ground based assets to an incoming ballistic missile. The gray area is what systems are components and at what stage of development do they become components. Certainly the Unmanned Autominous Vehicles (UAVs) as part of the BPI system serve the same sensor function as a TMD or ABM radar. If the BPI system is developed without modifying the ABM Treaty, will the UAVs be labeled as an ABM component because it can serve the same function as an ABM radar? The UAVs operating in a net are supposedly capable of detecting a ballistic missile launch and directing onboard hypervelocity missiles to an intercept up to a range of 220 km. The "ABM component" is one of many issues that are intensified by technological advancement, yet remain unaddressed.

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[68]Hans Gunter Brauch, ed., Star Wars and European Defence, p. 392. See also William J. Durch, The ABM Treaty, p. 70; and, Raymond Garthoff, "Correspondence: On Negotiating with the Russians," International Security, Summer 1977, p. 107-109.

[69]Hans Gunter Brauch, ed., p. 392.

4. Development

Certain aspects of the ABM Treaty text are referred to as "gray areas" because they are unrestrained by the treaty, but are similar to the ABM parameters. Herbert Lin suggests that a large "gray area" exists between the minimum threshold of National Technical Means (NTM) observation capabilities and actual component testing in the areas of air defense, TMD, and ASAT.[70] In other words, development of gray area systems is not likely to be easily observed by satellite, so they are not restricted. Although there is not a bilateral agreement on the meaning of the term "development" in the treaty, there are Unilateral Statements that attempt to clarify the meaning.

The problem with the definition of development, in the context of TMD, has been the possibility of clandestine ABM component development by one of the parties to the ABM Treaty. Since TMD development is one of the gray areas not normally monitored by NTM, ambiguity is the result if no boundaries are set between development and when a developed part reaches ABM component status. No specific agreed definition of development was reached during the ABM Treaty negotiations.

During the negotiations, the Americans proposed that development is the stage that follows research and that

[70]Herbert Lin, New Weapon Technology, p. 49. He writes that NTM can observe most component testing and a lot more besides that.

research includes the conceptual design and laboratory testing which precedes field testing.[71] Using the BPI development as an example, if the BPI is evaluated as non-ABM compliant, then it would be allowed under research only, but it could not be developed without submission to the Standing Consultative Commission for discussion. This is the barrier that President Reagan faced when he tried to "develop" spaced-based defenses by using the so-called "broad" interpretation. The broad interpretation did not stand and reaffirmed the ABM Treaty restriction that research on exotic weapons is allowed, but "development" is not. Where the demarcation line stands between research and development is key to the ambiguity as it relates to TMD.

5. Capability to Counter Strategic Ballistic Missiles

Article VI is currently at the center of the ABM controversy between the United States and Russia. Historically associated with the "SAM upgrade" problem, LPARs, and the "broad" interpretation, today's focus has shifted to TMD. The basic purpose of the article is to prohibit non-ABM systems or components from obtaining ABM capability. The ambiguous portions of Article VI are underlined and highlighted below:

> Each party undertakes **not to give** missiles, launchers, or radars, other than ABM interceptor missiles, ABM

[71]Matthew Bunn, Foundation for the Future, p.

launchers, or ABM radars **capabilities to counter strategic ballistic missiles** or their elements in flight trajectory, and not to test them in an ABM mode.

Not to deploy in the future radars for early warning of strategic ballistic missile attack except at locations **along the periphery of its national territory and oriented outward.**[72]

The uncertainty about this article is undefined words and phrases. In this case, the phrase "not to give missiles, launchers, or radars *capabilities to counter strategic ballistic missiles*" is vague, because the phrase "strategic ballistic missile" is undefined in the ABM Treaty. So, ABM and non-ABM systems are defined by their ability to counter strategic ballistic missiles. By inference only, theater missile defenses are those systems that do not have a capability against strategic ballistic missiles. The current theater defense problem arises because the question of "what is theater missile defense" cannot be answered without a clear definition of a strategic ballistic missile.

The resultant distinction between what constitutes theater missile defense and strategic missile defense is undemarcated and unclear. The ABM treaty does not specifically mention Theater Missile Defense or Anti-Tactical ballistic missile defense.[73] The parties assume that air defense and theater defense systems can be developed at will,

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[72]The ABM treaty, Art VI.

[73]The terms Theater Missile Defense (TMD) and Anti-Tactical Ballistic Missile (ATBM) defense are used interchangeably.

as long they are not given the "capability to counter strategic ballistic missiles" and are not "tested in an ABM mode."

Finally, the phrase "capabilities to counter strategic ballistic missiles" is also unclear, because the word "capabilities" is undefined. This major deficiency in the ABM Treaty is detrimental to TMD development and deployment, because it leaves unanswered two very important questions: (1) what is capability to counter an undefined target; and, (2) How is capability measured? These and other questions are the subject of current negotiations between the United States and Russia.[74]

a. What is a Strategic Ballistic Missile?

What is the definition of a strategic ballistic missile in the context of the ABM Treaty? What is the definition of a theater ballistic missile, and more importantly what is theater ballistic missile defense? There are indications that both members of Congress and the Department of Defense lack a clear understanding of Ballistic Missile Defense (BMD)[75], the ABM Treaty, and Theater Missile Defense (TMD). The comments of Senator Bumpers, from Arkansas--a long time opponent of BMD--typifies recent

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[74]Lisbeth Gronlund and others, "Highly Capable Theater Missile Defenses and the ABM Treaty," Arms Control Today, April 1994, p. 3.

[75]The terms ABM (Anti-Ballistic Missile) and BMD (Ballistic Missile Defense) are used interchangeably.

congressional debate on TMD funding. Senator Bumper's professed lack of knowledge on the subject does not appear to be just a ploy for effect:

> Mr. President, I do not mind telling you I am so weary. I have stood behind this desk now for five years and taken this on. Senator Johnston, one of the most knowledgeable members in this Senate on SDI, actually understands a lot of the technology. I confess, I do not. All I know is they have tried every technology under the shining sun, and they have just discarded them one after another, the technology. We have gone from Brilliant Pebbles now to Brilliant Eyes. What is that? What are Brilliant Eyes?[76]

The reality of Senator Bumper's comments is not very far from the truth. The nation's program for development of ballistic missile defenses changed dramatically over the last ten years and a complete understanding by all policy makers should not be assumed.

A strategic ballistic missile is not defined in the ABM treaty. Various authors cite the definition of strategic as being defined in other documents signed concurrently with the ABM treaty such as the Strategic Arms Limitation Talks (SALT).[77] The most commonly accepted definition of strategic ballistic missiles, when referring to land-based Inter-Continental Ballistic Missiles (ICBMs), is the ability to attack the "heartland" of another country or

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[76]Congressional Record, 9 September 1993, p. S11248.

[77]See Duncan Lennox, "Battling With the Ballistic Threat," Jane's Defense Weekly, 20 March 1993, p. 25. See also Sidney Graybeal and Patricia McFate, Defense News, November 15, 1993, p. 33. and Peter Zimmerman, "Key Point on ABM," Defense News, November 15, 1993, p. 34.

as having a range greater than 5500 km.[78] Since the ability to attack the "heartland" of another country would include Submarine Launched Ballistic Missiles (SLBMs) and Air-Launched Cruise Missiles (ALCMs) over 600 km in range, strategic ballistic missiles may have a range considerably shorter than 5500 km; in some cases the range may be as short as 600 km.

The major differentiation problem with theater missile defenses is that the ranges of strategic missiles and theater missile are not defined in the ABM Treaty. The question of range is not addressed; in fact, the ABM Treaty simply requires that theater defense radar, missiles and launchers are not to be given capabilities to counter strategic ballistic missiles and that they not be tested in an "ABM mode." The only definition that can be drawn from the ABM treaty is a capability-based definition based on the capability of a missile defense system to counter a strategic ballistic missile. Various authors explain that the ambiguities in the ABM Treaty attempted to protect U.S. and Soviet options to deploy Anti-Tactical Ballistic Missile (ATBM) systems, while simultaneously confining non-ABM systems to less full ABM capabilities.[79]

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[78]Ibid.

[79]William J. Durch, The ABM Treaty and Western Security, Cambridge, Mass: Ballinger Publishing Company, 1988, p. 53. Durch elaborates that 1000 km should be the cutoff range of ballistic missiles against which defenses could be deployed without constraint by the treaty. P. 121. See also Gerard Smith, Double Talk, Lanham, MD: University Press of

The ambiguity in the ABM Treaty as it relates to TMD is troubling because the distinction between strategic and theater ballistic missiles has changed significantly since the ABM Treaty was negotiated in 1972. ICBMs can be fired at ranges considerably below 5500 km and tactical or theater ballistic missiles can be fired at ranges between 300 and 3500 km. So the answer to the question of "at what ballistic missile range do we allow a TMD system to have a capability to defend?" can not be answered by referring to the ABM treaty.

b. What is Theater?

The TMD dilemma for the United States is caused by the lack of a definition of theater ballistic missile defense. Clearly, many so-called theater defensive missile systems are in development throughout the world today without any restraint. Theater ballistic missiles have changed considerably, since the ABM Treaty was negotiated in 1972, with some theater missiles now equaling the least capable strategic missiles existing at that time. Because TMD is not defined in the ABM Treaty, unrestrained development and capability could lead to abrogation of the ABM Treaty between the United States and Russia. Perception by parties to the treaty of a TMD system that has a capability (even if

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America, 1985, p. 314; and, Ashton B. Carter and David N. Schwartz, eds., Ballistic Missile Defense, Washington, D.C., The Brookings Institute, 1984, p. 230.

undefined) against a strategic ballistic missile, historically, produced more than "just cause for concern."[80]

The Department of Defense (DOD) has used unofficial and self imposed restraints to distinguish between tests against strategic and theater missile targets. By constraining the target speed and altitude to which a theater system could be tested, the DOD by practice, established TMD parameters as a demonstrated capability against a target traveling two km/sec or less and not more than 40 km altitude. Michael Krepon asserts that:

> Shortly after the ABM Treaty was signed, the Defense Department developed internal guidelines for developing and testing missile interceptors to assure conformity with the U.S. interpretation of treaty constraints. These guidelines required that any planned tests against targets traveling more than two kilometers per second and altitudes of more than 40 km be submitted for review by a Pentagon compliance committee.[81]

The so-called "Foster Box" criteria (theater missile target test limit of-2 km/sec and 40 km altitude) was established in 1972 by then-Director of Defense Research and Engineering John Foster.[82] There is no evidence that the former Soviet Union adhered to this criteria.[83]

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[80]Matthew Bunn, Foundation for the Future, p. 104-106. See also Brian Dailey, "Deception, Perceptions Management, and self-Deception in Arms Control: An examination of the ABM Treaty," in Dailey and Parker, Soviet Strategic Deception, p. 235.

[81]Michael Krepon, "Effective Theater Missile Defense Need not Undermine ABM," Defense News, 14 February 1994, p. 25.

[82]Lisbeth Gronlund, and others, "Highly Capable Theater Missile Defenses And the ABM Treaty," Arms Control Today, April 1994, p. 4.

[83]Michael Krepon, "Effective Theater Missile Defense Need Not Undermine ABM," p. 25.

The United States has endeavored to remain within its own self imposed restraints on TMD capabilities, but new TMD systems in development by the United States may have a capability to counter strategic ballistic missiles. The Theater High Altitude Area Defense (THAAD) system may be capable of defending against tactical ballistic missiles with ranges up to 3,500 km and maximum velocities up to five km/sec (i.e., Chinese CSS-2).[84] Under its current design, the THAAD system cannot be tested to its optimal capability, because of self imposed DOD restraints on velocities and range. Efforts to establish a distinction between theater and strategic missiles is difficult based on speed and altitude, because of similarities in performance characteristics. Table II illustrates the range of parameters involved.

Table II indicates that attempting to draw the line that separates theater from strategic missiles based on range alone is problematic because of the indeterminate range of SLBMs and the identification of individual systems. For example, if THAAD has a capability to counter a so-called theater missile of 3000 km range, then surely it would also have a capability against the SS-N-5 and the SS-N-6 *strategic ballistic missiles.*

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[84]Sidney Graybeal and Patricia McFate, "Redefine Theater Defense," Defense News, 15 November 93, p. 33.

TABLE II: KINEMATIC CHARACTERISTICS OF VEHICLES

Range (km)	Speed km/sec	Reentry angle (deg)	Apogee (km)	Vehicle
--	7.9	--	160	Satellite
Strategic	and Theater	(with "*")	Tactical	
10,000	7.2	22.6	1,325	MM II
7,400	6.7	28.4	1,261	Trident I
5,000	5.9	33.8	988	SS-20 (*)
4,100	5.4	36.0	813	Poseidon
2,500	4.5	39.4	560	SS-N-6
2,000	4.1	40.5	459	SS-4(*)
1,800	3.9	40.9	417	Pershing/II
1,400	3.4	41.9	331	SS-N-5
900	2.9	43.0	222	SS-12
720	2.6	43.4	177	Pershing I
500	2.2	43.9	120	SS-23
120	1.1	44.7	30	Lance/SS-21
Aerodynamic	Vehicles			
--	--	--	30	SR-71
200	1.0	--	20	SRAM

Source: Herbert Lin, New Weapon Technologies & The ABM Treaty, Pergamon-Brassey' International Defense Publishers, Mclean, VA., 1988, p. 13. For missiles, Lin assumed minimum-energy trajectories in a vacuum for the range-speed-apogee relations.
Note: Pershing II was considered a tactical missile.

Several of the self-imposed treaty restraints may inhibit technical advancements. "The Treaty already has interfered with the development of missile defense systems," Rep. Jon Kyl, R-Ariz., said in an August 12 interview. "We have had to conduct tests in odd ways to comply with the Treaty."[85] At a recent Senate Foreign Relations Committee

[85]Quoted in Neil Munro and Vago Muradian, "U.S. View On ABM Treaty May Kill Programs," Defense News, 16 August 1993, p.1. The article goes on to say that "Depending on how the treaty is interpreted and enforced

Hearing, when Senator Paul Simon (D-IL) asked whether it was true that: "if we don't modify the treaty, we can't develop THAAD?" Holum replied, "correct."

Daniel Graham (Former director, Defense Intelligence Agency) echoes the sentiment felt by TMD supporters:

> Our technology is outpacing the treaty. The line between strategic and tactical capabilities has been blurred almost beyond recognition...and the sad fact is we're having to dumb down our systems in order to comply with an outmoded treaty.[86]

The United States is attempting to draw the line that separates theater from strategic missile defense. The Clinton administration recently made a proposal to Russia via the SCC to modify the ABM Treaty including a recommendation that new agreed definitions be adopted to "clarify" how to interpret the treaty.[87] The United States proposed that a permitted interceptor be defined as one with a "demonstrated" capability to intercept a target re-entering the atmosphere at a velocity of up to 5 km per second (the velocity of the CSS-2).[88] Reportedly, the administration did not propose an

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it could block development of spaced-, sea- and even mobile ground-based missile defense systems that have long range or high altitude capabilities."

[86]Ibid. Quoted by Barbara Opall in a 13 September, 1993 interview with Daniel Graham.

[87]Lisbeth Gronlund and others, "Highly Capable Theater Missile Defenses and the ABM Treaty," Arms Control Today, April 1994, p. 3.

[88]See Dunbar lockwood, "U.S. Proposal to Retool ABM Treaty Reopens Debate on Missile Defense," Arms Control Today, January/February 1994, p. 24; and, Theresa Hitchens and Barbara Opall, "THAAD May be Treaty Debate Fulcrum," Defense News, 11 April 1994, p. 1.

altitude restriction, but while agreeing that clarification of the treaty is necessary, the Russians argued that the single criterion of velocity was insufficient. The administration's interest in the proposal is heightened by its desire to develop the THAAD system to counter missiles of up to 3500 km range.[89] This dilemma, according to Theresa Hitchens, in the U.S.-Russian talks to revise the ABM Treaty: "may force the U.S. government to choose between a sure deal to protect THAAD or gamble on a strategy to include future Navy and Air Force systems."[90]

Several authors have suggested range and capability-based distinctions to define the difference between strategic and other ballistic missiles. William Durch recommends 1000 km as a cutoff for the range of ballistic missiles against which defenses could be deployed without constraint by the ABM Treaty. He justifies this range limit as a figure compatible with the 1000 km floor of the Intermediate Range Nuclear Forces (INF) Treaty.[91] Herbert Lin concludes that verifiable limits on TMD systems might be established using capability-based measures: (1) limits on

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[89]Dunbar Lockwood, "Senators Appear Skeptical of ABM Treaty Modifications," Arms Control Today, April 1994, p. 17. The reentry vehicle speed of a 3500 mile missile is roughly five km per second for a minimum energy trajectory.

[90]Theresa Hitchens and Barbara Opall, "THAAD Mat be Treaty Debate Fulcrum," Defense News, 17 April 1994, p. 1.

[91]William J. Durch, The ABM Treaty and Western Security, p. 121.

the physical size of interceptor missiles; (2) limits on missile kinematics; and, (3) limits on power-aperture product of mobile radars.[92] The suggested capability measures apply only to the capabilities of the interceptor, and not to the interceptor capability against a strategic missile.

Clearly, the United States and other countries need to have a system to defend against use of tactical ballistic missiles in future regional conflicts. However, the consequences of unrestrained unilateral TMD development will make the distinction between tactical and strategic missiles less clear. If TMD systems are not limited by capability or range-based system design, then no restraints will exist to limit the ability of TMD systems to counter strategic ballistic missiles.

c. Demonstrated Capability Vs Inherent Capability

Another area of contention, that surfaced in the administration's ABM Treaty modification proposal, was the introduction of the term "demonstrated capability." The ABM Treaty prohibition forbids that non-ABM systems be given "capability to counter strategic ballistic missiles." The Clinton administration has proposed that the "capability

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[92]Herbert Lin, New Weapon Technologies, p. 45-48. "Lin suggests a ceiling on power-aperture product for all mobile radar, based on the estimated product of the Patriot air defense radar. The suggested volume/length limit on SAMs and TMD interceptors would be eight meters in length and 2.5 cubic meters in volume. For testing limits Lin would define an 'ABM target' as an object that achieves *either* a speed in excess of three km/sec or an altitude of greater than 70 km."

prohibition on TMDs be dropped in favor of a "demonstrated capability" prohibition.[93] This distinction would allow the theoretical development of TMD systems that would be regarded as a theater, and not a strategic system, as long as it is never tested (demonstrated) against a target with a reentry speed greater than five km per second.[94]

Opposition to the Clinton administration's proposal is not just from the Russians. Arms control advocates assert that systems like THAAD and the proposed sea-based upper-tier definitely have a capability against strategic ballistic missiles.[95] If the United States is allowed to develop and deploy systems such as THAAD that possess a capability against strategic ballistic missiles, as long as it does not test them against a target traveling more than five km per second. This scenario generates the capability versus intent argument all over again. This is

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[93]Lisbeth Gronlund and others, "Highly Capable Missile Defenses and the ABM Treaty," Arms Control Today, April 1994, p. 4. See also Theresa Hitchens, "Treaty Rewrite Would Bolster Tactical Defenses," Defense News, 20 December 1993, p. 4.

[94]Ibid. The authors suggest that "the Clinton administration has concluded that such an agreed interpretation, together with the change to a 'demonstrated capability' prohibition is necessary to allow the United States to conduct tests of the THAAD system--scheduled to begin later this year--without violating the ABM Treaty."

[95]Interview between John Pike, Director of the Space policy Project, The Federation of American Scientist, Washington, D.C., and the Author, 21 April 1994. For a recent study (by the Arms Control Association) that concludes that THAAD will have a significant capability against strategic ballistic missiles, see Lisbeth Gronlund and others, "Highly Capable Theater Missile Defenses and the ABM Treaty," Arms Control Today, April 1994, p. 3.

the same capability-versus-intent argument used by the United States against the former Soviet Union's Backfire Bomber.[96] Jack Mendelsohn captures the essence of the opposition for the arms control community:

> This means that a super-capable ATBM, which we all know would have ABM capability, would not be in violation of the treaty unless it actually demonstrated this capability. This is the old 'capability-versus-intent' argument, and the United States, over time, constantly used the capability argument and not the intent argument as a basis for posing challenges.[97]

Congressional opposition hinges on whether the magnitude of the proposed change to the ABM Treaty will require Senate advice and consent. In a letter to President Clinton on 25 March, 1994, all 44 Republican Senators urged him to resist any restrictions on TMD systems beyond the original U.S. proposal.[98] In addition the letter alerted the president that "there is an emerging consensus in the Senate that any agreement to substantially modify the ABM treaty should be submitted by the Administration for advice and consent."[99]

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[96]Department of Defense, "Soviet Strategic and Space Programs," Government Printing Office, Washington, D.C., 1990, p. 4. The U.S. asserted that this bomber is capable of performing a one way strategic mission against the U.S., but the Soviets claimed the bomber was intended for tactical missions only.

[97]Jack Mendelsohn and others, "A New Threat to the ABM Treaty: The Administration's TMD Proposal," Arms Control Today, January/February 1994, p. 13.

[98]Dunbar Lockwood, "U.S. Rejects Moscow's Proposal To Limit ATBM Interceptor Speeds," Arms Control Today, May 1994, p. 19.

[99]Ibid.

Some TMD proponents argue that the capability of the THAAD system against a strategic ballistic missile is "highly overstated."[100] Baker Spring admits, that the THAAD system "probably has some capability against a strategic ballistic missile, but only from a military sense, and not a political one."[101] In other words, we would have to possess the political will (a.k.a., intent) to deploy THAAD to provide that "base" for a nationwide defense of territory. The administration wants to develop THAAD and other systems of similar capability, so they have proposed the ABM treaty modifications as a clarification via the SCC, rather than as an amendment, ostensibly to avoid Congressional ratification.

In summary, Article VI of the ABM Treaty is ambiguous today. Because this article is clouded by the lack of a definition for "capability against strategic ballistic missiles," it is probably perceived as providing the greatest possibility of providing a breakout from the ABM Treaty. The very fact that the administration's proposal clouds the issue further, by adding a third complication of "demonstrated capability," will not likely be successful in today's arms reduction environment. Additionally, an irrefutable argument made by John Rhinelander is that the dual restrictions of Article VI--the prohibition of ABM capability and testing in

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[100]Interview between Baker Spring, Senior Policy Analyst, The Heritage Foundation, Washington, D.C., and the author, 17 May 1994.

[101]Ibid.

an ABM mode--will be abrogated and eliminate the double standard:

> These dual restrictions are critically important and if you modify treaty text so that capabilities must be demonstrated, you have effectively gone to a single standard where testing is the only real restriction. This is exactly what we avoided in for good reasons during SALT I negotiations.[102]

Both critics and proponents agree that the ABM Treaty is sorely in need of change, but it appears that the specifics of any compromise will not take the form or perspective of the administration's proposal.

C. SUMMARY: CHANGES NEEDED

This chapter was a thorough review of the ABM Treaty as it relates to TMD. The original premise that the treaty is still ambiguous in the same areas perceived to be ambiguous in 1972 is supported by the review. It is noteworthy that the attachments to the treaty containing seven Agreed Statements, five Common Understandings, and four Unilateral Statements were mostly written to clarify ambiguities pertaining to ABM defenses. Yet many of ambiguities, previously considered applicable only to ABM systems, were demonstrated to be applicable to today's TMD as well. Although the review only concentrated on the first six

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[102]John Rhinelander, "A New Threat to the ABM Treaty: The Administration's TMD Proposal," Arms Control Today, January/February 1994, p. 14.

articles of the treaty, the majority of items considered ambiguous were examined for applicability to TMD.

The ABM Treaty is unclear in many areas but its three major deficiencies are: (1) undefined terms and phrases; (2) the functional nature of the treaty; and (3) length of treaty text.

The review revealed that the treaty contains more than 10 ambiguous words and phrases that directly affect the distinction between a TMD and an ABM system. Many of these ambiguous words and phrases are directly affecting the development of planned U.S. systems today. Unanswered questions remain about the BMDO meeting the THAAD flight-test schedule because of treaty concerns. It appears that the treaty is effective in restricting systems that are obviously ABM systems such as LPARs, but lacking for those systems that would be capable of substituting for LPARs, such as the Brilliant Eyes satellite.

The functional nature of the ABM Treaty served it well over the years. Proponents often make the argument that this is the strength of the treaty; it prohibits an ABM system by defining the prohibited function instead of the prohibited system (e.g., an ABM system is a system able to counter a strategic ballistic missile). These arguments are correct, but to remain effective, the treaty should be modified periodically to handle technological advancements. My premise is that the treaty is ill-suited to restrain today's

TMD and is overdue for modification. In the case of THAAD, BPI, and Navy upper-tier TMD systems, capability "to counter strategic ballistic missiles," is inherent to these systems and is no longer the question for TMD.

The brevity of the ABM Treaty, surprising by today's standards, is probably its greatest weakness. Brevity is not normally cause for ambiguity, but the ABM Treaty, at roughly 6 pages of text, is dwarfed by the INF (90 pages) and START I (250 pages) treaties. Additionally the main causes for ambiguity in the ABM Treaty are corrected in START and other arms control treaties. The ABM Treaty is only 22 years old, but it appears to be much older in terms of handling technological advancements.

III. CURRENT THEATER SYSTEMS & THE ABM TREATY

In May, 1993 United States shifted ballistic missile defense priorities from a National Missile Defense program, which would use some spaced based assets, to a ground-based program with Theater Missile Defense (TMD) as a priority. Today's "terminal defense" systems are designed to intercept ballistic missiles in the final two minutes of flight. Some proposed TMD systems, such as Boost Phase Intercept (BPI), target the threat missile in the first two minutes of flight. The Ballistic Missile Defense Organization (BMDO) is currently developing its so-called "core programs": the Patriot PAC-3[103], the U.S. Navy's lower-tier system, and the Theater High Altitude Area Defense (THAAD). Long-term projects include the Navy's sea-based upper-tier, Boost Phase Intercept (BPI), and the Army's Corps Surface-to-Air Missile (Corps SAM). The Upper-Tier (UT) and Lower-Tier (UT) designations refer respectively to exoatmospheric (>100 km) and endoatmospheric (<100 km) range capability. Table III delineates America's theater missile defense systems under consideration or development.

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[103]It appears that the Extended Range Interceptor (ERINT) will now replace the Patriot PAC-3 as the lower-tier portion of the Army's theater missile defense effort. See David Hughes, "Army Selects ERINT Pending Pentagon Review," Aviation Week & Space Technology, 21 February 1994, p. 93.

TABLE III: U.S. THEATER MISSILE DEFENSE PROGRAMS

System	Service/Tier	Warhead*/Range	Deployment
Core Programs			
THAAD	Army/UT	HTK/ 160 km	2001 #
Navy SM2 BK-4A	Navy/LT	Frag/Mid endo	1999 **
Patriot PAC-2	Army/LT	Frag/ 70 km	1995
Patriot PAC-3	Army/LT	HTK/ Mid endo	1998
Hawk Upgrades	USMC/LT	Frag/ 35 km	1995-98
Israeli Arrow	--/UT	Frag/ 90 km	1995-99
Technology Demonstrators			
Navy SM-2 LEAP	Navy/UT	HTK/ >150 km	Aquire/Demo
CORPS SAM	Army/LT	-- 30-40 km	Study
Peregrine	AF/BPI	-- 250 km	Study
RAPTOR/TALON	AF/BPI	HTK/ 220 km	Study
Airborne Laser	AF/BPI	-- --	Study

Source: David Hughes, "BMDO Under Pressure To Set Priorities," Aviation Week & Space Technology, 17 January 1994, p. 49; "US Evaluates Candidates for Boost Phase Intercept," International Defense Review, November 1993, p. 850; Joseph Lovece, "Theater Missile Defense "Core" Will Cost $21 Billion," Defense Week, 14 February 1994, p. 1; Robert Holzer and Barbara Opall, "U.S. Navy Fights BMDO for Antimissile Funds," Defense News, 11 April 1994, p. 8.

Notes: (#) A government option for 40 missiles, two radars, and two (BMC3), deliverable in 1996, can be exercised.
(**) Contingency availability in limited numbers-1997/98.
(*) Warhead type (HTK) = Hit-To-Kill; (Frag) = Fragmentation.
RAPTOR = Responsive Aircraft Programs for Theater Operations.
TALON =Theater Applications-Launch ON Notice (3.3 km/sec msl).

Table III depicts concerted U.S. TMD development. Not counting the Patriot multimode seeker, which was eliminated

in favor of the ERINT[104] as a LT backup to THAAD, there are five core programs planned for full scale development. There are six TMD systems under study for possible future development, for a total of 11 systems being funded by the United States. The Israeli Arrow program is also majority funded by the United States with a requested budget of $52 million dollars submitted by the BMDO for FY 1995.[105] Although not included in Table III, the Brilliant Eyes satellite program is reportedly still targeted by BMDO as an acquisition program with a requested funding level of $120 million in FY 1995.[106] In summary, funding restraints will be a major issue in the near future. A 1993 study conducted by the Congressional Budget Office revealed that current administration budget projections and deployment schedules through 1999, will only support funding for two of three TMD "core" programs (THAAD and PAC-3).[107]

Both the Navy and the Army have upper-tier and lower-tier TMD systems under consideration. The CORPS SAM is also a

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[104]"Loral Gains Ballistic Missile Upper Hand," Defense Electronics, May 1994, p. 10.

[105]Joseph Lovece, "Theater Missile Defense "Core" Programs Will Cost $21 Billion," Defense Week, 14 February 1994, p. 1.

[106]Joseph Lovece, "Missile Defense Budget Avoids Making the Hard Choices," Defense Week, 8 February 1994, p. 5.

[107]David Mosher, "Theater Ballistic Missile Defenses: Selected Issues," Congressional Budget Office Staff Memorandum, Washington, D.C., July 1993, p. 16. This study assumes funding for required battle management, and that funding for non-TMD defenses remains at levels requested by the Administration for 1994 and adjusted for inflation; funding for all other TMD programs is eliminated.

lower-tier systems under study by the U.S. Army as a replacement for the US Army and Marine Corps HAWK systems. The three BPI systems, enumerated in Table IV, do not account for the air-to-air interceptor modifications necessary to employ the Air Force's Peregrine concept. The following sections will assess the impact of United States' TMD programs on the ABM Treaty.

A. ARE TODAY'S TMDs CAPABLE AGAINST STRATEGIC BALLISTIC MISSILES?

Determining if a TMD system can intercept a strategic ballistic missile is a multi-faceted problem. Assumptions of detection range, target characteristics, interceptor uncertainties, external cueing, and the shape and location of the protected area relative to both the target and interceptor launch sites are the major variables[108]. A recent study completed by TMD opponents used the defended THAAD "footprint"--the ground area the interceptor can protect against an attacking missile--as a key measure of capability against strategic ballistic missiles.[109] The study assumes one attacking warhead at a time, and did not include the possible effects of nuclear weapons, such as salvage fusing

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[108]"Ballistic Missile Defense" Testimony Before the Committee on Foreign Relations, United States Senate, Statement by Brad Hathaway, General Accounting Office, Washington, D.C., GAO/T-NSIAD-94-167, 3 May 1994, p. 7.

[109]Lisbeth Gronlund and others, "Highly Capable Theater Missile Defenses and the ABM Treaty," Arms Control Today, April 1994, p. 3.

or nuclear blast keep-out zones. Sidney Graybeal, a former U.S. ABM Treaty Negotiator, admits that THAAD probably has some capability against a strategic ballistic missile in a one-on-one isolated attack, but that "stand-a-lone footprint analysis should not be used as a measure of capability....Capability is determined by National Technical Means (NTM), not by computer analysis."[110]

Both critics and proponents of TMD acknowledge that THAAD has some capability against a strategic ballistic missile.[111] The trouble with the current analysis of today's TMD capability against a strategic ballistic missile is the same ambiguous word "capability," that so plagued the ABM Treaty negotiations over the years. In other words, the critics of today's TMD hinge their argument on the same undefined "capability to counter a strategic ballistic missile," that promotes unrestrained TMD development. John Pike, of the Federation of American Scientists, believes we have developed too much "capability" for the threat which "on the most part, consists of ballistic missiles with ranges less than a 1,000 kilometers."[112]

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[110]Interview between Sidney Graybeal, Senior Scientist, Science Applications International, Mclean, VA., and the Author, 23 May 1994.

[111]Theresa Hitchens and Barbara Opall, "THAAD May Be Treaty Debate Fulcrum," Defense News, 11 April 1994, p. 1; Spurgeon M. Keeny, Jr., "A New Threat to the ABM Treaty: The Administration's TMD Proposal," Arms Control Today, January/February 1994, p. 11; and, Interview between Baker Spring, The Heritage Foundation, and the author, 29 April 1994.

[112]Interview between John Pike, The Federation of American Scientists, Washington, D.C., and the Author, 21 April 94. See also

Does the capability to counter a conventionally armed ballistic missile also mean capability against a nuclear armed strategic ballistic missile? Any rigid analysis of TMD "capability" against a conventionally armed ballistic missile, can not use the same assumptions for a nuclear strategic ballistic missile because of differences in warhead blast zones. This section attempts to analyze whether current U.S. systems have a "capability to counter a strategic ballistic missile," by the use of a model that combines a standard surface-to-air interceptor problem, that is overlaid with nuclear blast keep-out zones for three typical size nuclear weapons. This type of examination attempts to take the analysis beyond what Sidney Graybeal refers to as "the problem with drawing footprints in isolation...literally, even a rock has a footprint...."[113] In short, this type of model addresses the differences in intercepting conventionally armed RVs versus nuclear armed RVs when assessing TMD capability against strategic ballistic missiles. Since the typical TMD system is designed to counter conventionally armed theater ballistic missiles, any assessment of TMD capability against strategic ballistic missiles must consider nuclear blast effects.

Steven A. Hidreth, "The ABM Treaty and Theater Missile Defense: Proposed Changes and Potential Implications," U.S. Library of Congress Congressional Research Service, CRS report 94-379F, Washington, D.C., 5 May 1994, p. 12

[113]Interview between Sidney Graybeal and the Author, 23 May 1994.

The use of salvage fusing as a countermeasure against ballistic missile defense should be considered, if nuclear reentry vehicles are intercepted by TMD missiles, in close proximity to the impact point. "Salvage fusing is the technigue of programming a warhead so that it detects when it is about to be destroyed by enemy defenses and automatically explodes so as to cause damage to the defenses rather than just being neutralized."[114] The effects of the nuclear blast could be just as devastating as no defense at all.

When TMD systems are perceived as having the "capability to counter a strategic ballistic missile," and therefore providing a "base" for a nationwide ABM defense of territory, their ABM role is assumed. But, a TMD system would still have to cope with possible countermeasures. ABM countermeasures such as defense saturation, decoys, radar blackout, jamming, Electromagnetic Pulse (EMP), radar vulnerability, defense leakage, and salvage fusing would comprise major offensive measures that could be taken against an assumed TMD. A covert TMD might deal with some countermeasures, but the prospect of salvage fusing would render some TMD systems useless due to the close proximity of the TMD interceptor to the impact point at RV interception.

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[114]Alun Chalfont, Star Wars: Suicide or Survival, Weidenfeld & Nicolson Limited, London, 1985, p. 90. See also Robert M. Lawerence, Strategic Defense Initiative, Westview Press, Boulder, Colorado, 1987, P. 145.

Nuclear weapons detonations in the atmosphere produce blast waves, thermal radiation and nuclear radiation, but damage criteria are generally based on the blast wave overpressure.[115] Figure 1 illustrates the relationship of overpressure to distance from explosions of different yields.

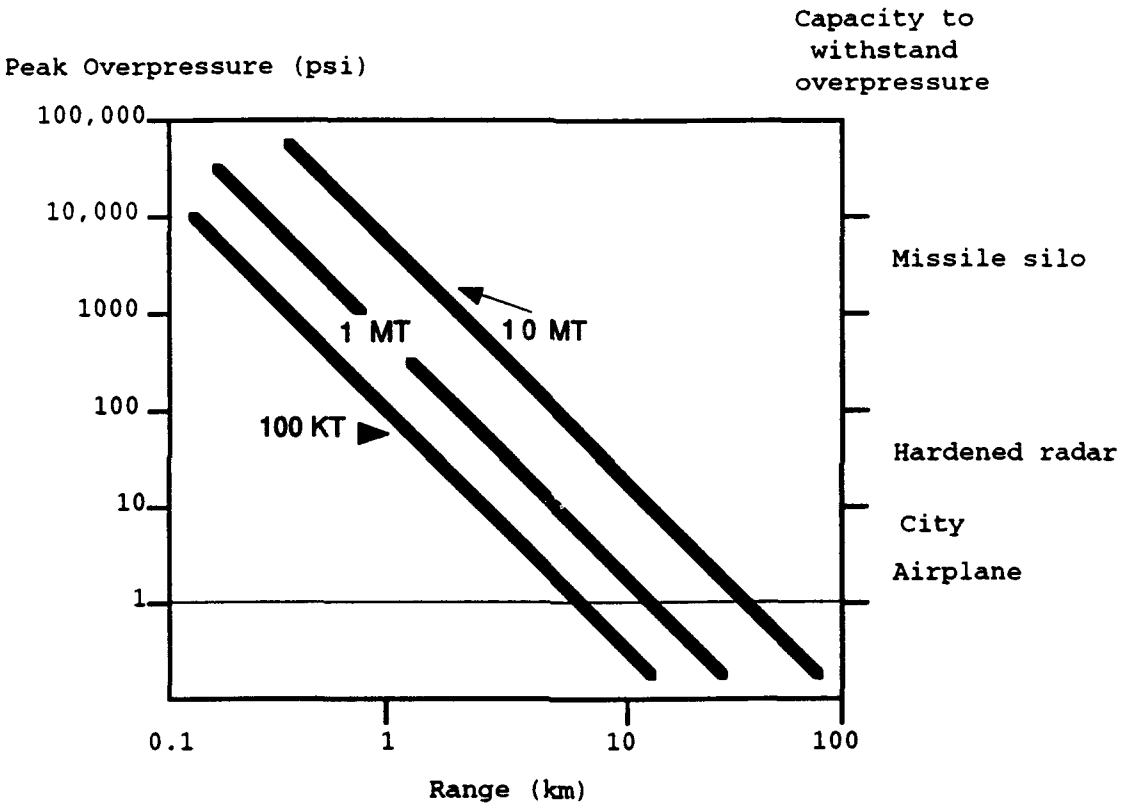

Figure 1: Relationship of Overpressure to Distance from Nuclear Explosions of Different Yields

Source: Ashton B. Carter and David N. Schwartz, eds., Ballistic Missile Defense, The Brookings Institution, Washington, D.C., 1984, p. 54. Atmospheric pressure assumed at sea-level.

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[115]Ashton B. Carter and David N. Schwartz, eds., Ballistic Missile Defense, The Brookings Institution, Washington, D.C., 1984, p. 53.

The overpressure measured in pounds per square inch (psi) is a function of weapon yield measured in megatons (MT) and the range from the burst.[116]

In this example, the so-called "keep-out" zone will be one psi overpressure, for an assumed population defense with minimal damage. Table IV illustrates the severity of the winds generated by an overpressure of five psi.

TABLE IV: OVERPRESSURE AND MAXIMUM WIND VELOCITY IN AIR AT SEA LEVEL CALCULATED FOR AN IDEAL SHOCK FRONT

Peak Overpressure (psi)	Maximum Wind velocity (mph)
200	2,078
150	1,777
100	1,415
72	1,168
50	934
30	669
20	502
10	294
5	163
2	70

Source: Samuel Glasstone and Phillip J. Dolan, eds., The Effects of Nuclear Weapons, Department of Defense, Washington, D.C., 1977, p. 82.

Within a nuclear weapon blast ring where the blast overpressure is five psi, nearly all conventional houses will

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[116]Ibid.

be damaged beyond repair.[117] At distances from the nuclear burst, where the blast overpressure is one psi, the destructive effect of the air blast wave is minor.[118] If the intent of TMD development is eventual ABM capability, then the "keep-out" zone of one psi should be adequate for population defense.

For each major TMD system listed in Table III, the one-psi keep-out zones for a 10 MT, one MT, and 100 KT explosion are overlaid on the standard surface-to-air missile intercept diagram as a measure of effectiveness. This method is similar to an approach used by Herbert Lin to examine the performance of SAM systems against ABMs in 1988.[119] The major assumptions are as follows: (1) The incoming nuclear reentry vehicle is salvaged fused; (2) The major effect from the nuclear explosions will be the blast effect--all other effects are assumed minor; (3) one attacking warhead at a time; (4) the TMD system is assumed to be EMP protected; (5) each interceptor missile is assumed to have 100 percent reliability from launch to intercept; and, (6) the interceptor is assumed to be located at the impact point.

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[117]Samuel Glasstone, ed., The Effects of Nuclear Weapons, United States Atomic Energy Commission, Washington, D.C., 1962, p. 629. The author further asserts: "apart from fortuitous circumstances, few persons will survive who have not sought protection in strong structures or shelters which will withstand the fire, blast, and shock and which will attenuate the radiation."

[118]Ibid.

[119]Hebert Lin, New weapon Technologies, p. 76.

1. THAAD

Theater ballistic missile defense development in the United States uses a terminal defense model that consist of two or more layers of missile interceptors. This model arranges to have two or more shots at a reentry vehicle (RV), by providing two hurdles for the offense.[120] The layers are referred to as the upper tier--meaning exoatmospheric or area defense--and lower tier--meaning endoatmospheric or point defense.[121] The U.S. ARMY and the Navy are planning to develop both upper and lower tier defenses.

THAAD is the Army's upper tier and the first system ever developed for endoatmospheric and exoatmospheric defense against theater ballistic missiles. The system consists of interceptor missiles, launchers, Battle Management/Command, Control, Communications and Intelligence (BM/C3) units and the TMD-Ground Based Radar (TMD-GBR). THAAD is an area defense system expected to deploy as a truck-mounted launcher carrying 12 missiles and capable of being air-transportable. THAAD reportedly will be able to defend a large area with a radius of at least 160 km. The system's long interceptor range will supposedly give the THAAD system at least two

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[120]Ashton B. Carter, "BMD Applications: Performance and Limitations," in Ashton B. Carter and David N. Schwartz, eds., Ballistic Missile Defense, The Brookings Institution, Washington, D.C., 1984, p. 104.

[121]Exoatmospheric generally refers to the region above the atmosphere normally greater than 100 km; endoatmospheric refers to inside the atmosphere and generally less than 100 km.

shots at an incoming RV.[122] Additionally, the THAAD system will perform in concert with external sensors and lower-tier defenses (i.e., Brilliant Eyes, Patriot, and Corps SAM) to engage and neutralize incoming missiles.[123]

The THAAD system has not been flight tested, but it reportedly is designed to intercept theater ballistic missiles that have a range of up to 3500 km. The 3500 km range is important because the speed of the incoming RV, at 3500 km, is about five km/sec--the Clinton administration's proposed maximum RV speed for TMD demarcation in the ABM Treaty. Its a highly capable interceptor that employs hit-to-kill (HTK) technology, reaches speeds of 2.5 to 2.7 km per second, and intercepts incoming missiles up to 100 miles downrange.[124] The missile consists of a single-stage solid propellant rocket motor and a kill vehicle; the kill vehicle separates from the booster and employs an infrared seeker prior to impact. THAAD's planned deployment is scheduled for 2001, but a so-called User Operational Evaluation System (UOES)--can be delivered at the end of the

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[122]COL. W. Fredrick Kilgore, "Theater High Altitude Area Defense Program," A U.S. Army White Paper, THAAD Project Office, Huntsville, AL., 4 February 1994 p. 1.

[123]Ibid. This system interoperability will provide an opportunity for three shots at an incoming missile in some cases.

[124]David Hughes, "BMDO Under Pressure to Set TMD Priorities," Aviation Week & Space Technology, 17 January 1994, p. 50; and, Clifford Beal, "Racing to Meet the Ballistic Missile Threat," International Defense Review, March 1993, p. 213.

Demonstration/Validation (DEM/VAL) program in 1996.[125] The UOES option would be a hedge, available in a national emergency, consisting of 40 prototype missiles, two TMD-Ground Based Radars (GBR), and two Battle Management/Command, Control, Communications and Intelligence (BM/C3I) units.[126]

THAAD's future is unclear because its alleged capability to counter strategic ballistic missiles may interfere, or even halt, the 24 month DEM/VAL phase of development scheduled to begin in September, 1994.

Does THAAD have the capability to intercept a strategic ballistic missile? Figure-2 illustrates THAAD's intercept capability against a strategic RV traveling at 7.2 km/sec. The diagram is an adoption of Herbert Lin's model of SAM performance against a strategic Ballistic Missile, except that target detection range is assumed, and, [one psi] keep-out zones are plotted for nuclear blasts of one MT and 10 MT.[127] THAAD is highly capable against a strategic ballistic missile in this very simplistic scenario. Additionally, the intercept point lies outside the 10 MT keep-out zone, thereby increasing THAAD's capability against the countermeasure of salvage fusing. Essentially, this analysis supports the

[125]Interview between William Loomis, Vice-President for Defensive Missile Systems, Lockheed Missiles & Space Co., Sunnyvale, CA., and the author, 29 April 1994.

[126]Ibid.

[127]For SAM performance, see Herbert Lin, New Weapon Technology, p. 74-78; for nuclear keep-out zones see Samuel Glasstone, The Effects of Nuclear Weapons, 1962, p. 630.

premise that THAAD does have a significant military capability against strategic ballistic missiles. The advertised shoot-look-shoot doctrine could not be used in this scenario, because the range of the RV at intercept would not allow time for target damage assessment.

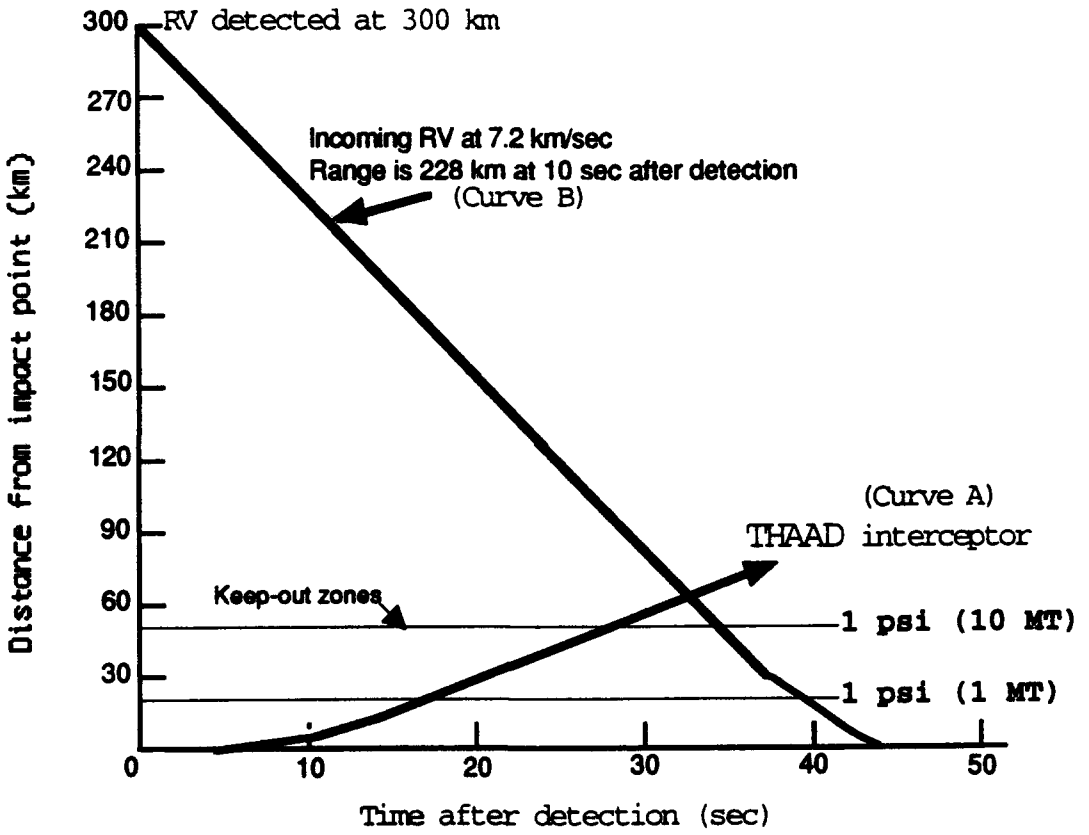

Figure 2: THAAD Interceptor Versus Strategic RV

Strategic RV detection range is assumed to be 300 km (two times the interceptor range). The THAAD interceptor is launched after a five second delay for trajectory computations; the interceptor is plotted at 2.6 km/sec at a 30g acceleration. The RV is assumed to be a 10,000 km ballistic missile (from Table III) on a minimum energy trajectory with a reentry speed of 7.2 km/sec. No allowances are made for improvements in footprints due to radar or interceptor placement.

Both critics and proponents of TMD support the premise that THAAD has some capability against strategic ballistic missiles. Proponents will quickly add: "that the capability is only in a military sense and not a political one."[128] In other words, just because THAAD is allegedly capable against a strategic ballistic missile, does not mean that there is a political intent to use the military capability. However, this is the capability versus intent argument that the United States frequently used against the former Soviet Union and, therefore, it is unlikely to prevail. The THAAD capability study recently published in *Arms Control Today* concluded that "If an ATBM system is both robust against countermeasures and has a large footprint (with a radius of 100 kilometers or more) against 3,000 to 3,500 range TBMs, it will inevitably have a substantial capability against strategic targets."[129] The study criticized the Clinton Administration's ABM Treaty proposal for establishing, only a 40 percent gap, between the reentry speed of strategic warheads and the maximum speed that TMD systems can be tested against. The Administration proposed that the ABM Treaty should be "clarified," by defining TMD, as those systems with interceptors that have a demonstrated

[128]Interview between Baker Spring, The Heritage Foundation, Washington, D.C., and the Author, 17 May 1994.

[129]Lisabeth Gronlund and others, "Highly Capable Theater Missile Defenses and the ABM Treaty," Arms Control Today, April 1994, p. 8.

capability against reentry vehicles traveling at less than five km per second.[130] Strategic ballistic missiles typically have reentry speeds of seven to eight km per second--a gap of only 40 percent.[131]

Steve Hildreth illustrated the "40 percent gap is not enough" argument much more effectively in a recent *Congressional Research Service* report. He demonstrates that Patriot PAC-2 missiles were used against Iraqi-modified scuds whose peak velocities were 40 percent faster than the Patriot PAC-2 was designed for and tested against.[132] Hildreth concludes that assuming the Patriots were still 50 percent effective against the Scuds, then the logical analogy is: "that demonstrated missile defense capabilities do not degrade catastrophically, immediately beyond an upper test limit; instead these capabilities degrade gracefully."[133]

The issue, therefore, is no longer whether THAAD is capable of countering a strategic ballistic missile, but rather *how* will the demarcation line be established between TMD and ABM systems. More importantly, how will the issue of the TMD/ABM demarcation line affect the testing and

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[130]Dunbar Lockwood, "Senators Appear Skeptical of ABM Treaty Modifications," Arms Control Today, April 1994, p. 17.

[131]See Table III, in Chapter two, for the relationship of ballistic missile range to RV speed and reentry angle.

[132]Steven A. Hildreth, "The ABM Treaty and Theater Missile Defense: Proposed Changes and Potential Implications," U.S. Library of Congress, Congressional Research Service, report 94-374F, 2 May 1994, p. 13.

[133]Ibid.

development of U.S. systems already scheduled for deployment (i.e., THAAD).

2. Navy Upper-Tier

The Navy's is also developing a two-tiered approach to TMD. The Navy's upper-tier plan uses Aegis cruisers and destroyers as sea-based platforms to defend an area with a radius of a few hundred kilometers.[134] The Navy's primary candidate for an exoatmospheric interceptor is the Standard anti-air missile (SM2 ER Block IVA) combined with a Lightweight Exoatmospheric Projectile (LEAP) and a solid propellant kick stage. This combination would project a hit-to-kill interceptor to exoatmoshperic altitudes at a speed of approximately 4.5 km per second--almost twice the speed of THAAD.[135] There are other options to deploy a so-called "marinized" version of THAAD in the existing vertical launchers on Aegis ships or develop a completely new interceptor.[136]

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[134]See Nick Cook, "France, USA Lead the Way with TMD Talks," Jane's Defense Weekly, 19 March 1994, p. 1; Barbara Starr, "Navy TMD Waits for Funding," Jane's Defense Weekly, 12 March 1994, p. 20; and, David Hughes, "Aegis Ships to Fill Two-Tier Antimissile role," Aviation Week & Space Technology, 7 June 1993, p. 127.

[135]See Duncan Lennox, ed., Jane's Strategic Weapon Systems, Jane's Information Group, Surrey, UK, 1990; Joris J. Lok, "USN Prepares 'Make or Break' LEAP tests," Jane's defense weekly, 23 April 1994, p. 13; and, Dunbar Lockwood, " U.S. Rejects Moscow's Proposal to Limit ATBM Interceptor Speeds," Arms Control Today, May 1994, p. 19.

[136]Interview between William loomis, Vice-President for Defensive Missile Systems, Lockheed Missiles and Space Co., Sunnyvale, CA, and the author, 29 April 1994.

The use of Aegis as an upper-tier TMD is already depicted as capable of providing an area defense of the United States in an emergency. Figure-3 illustrates the capability of the (SM-2 Block IV-A LEAP) against the same threat demonstrated in figure-2.

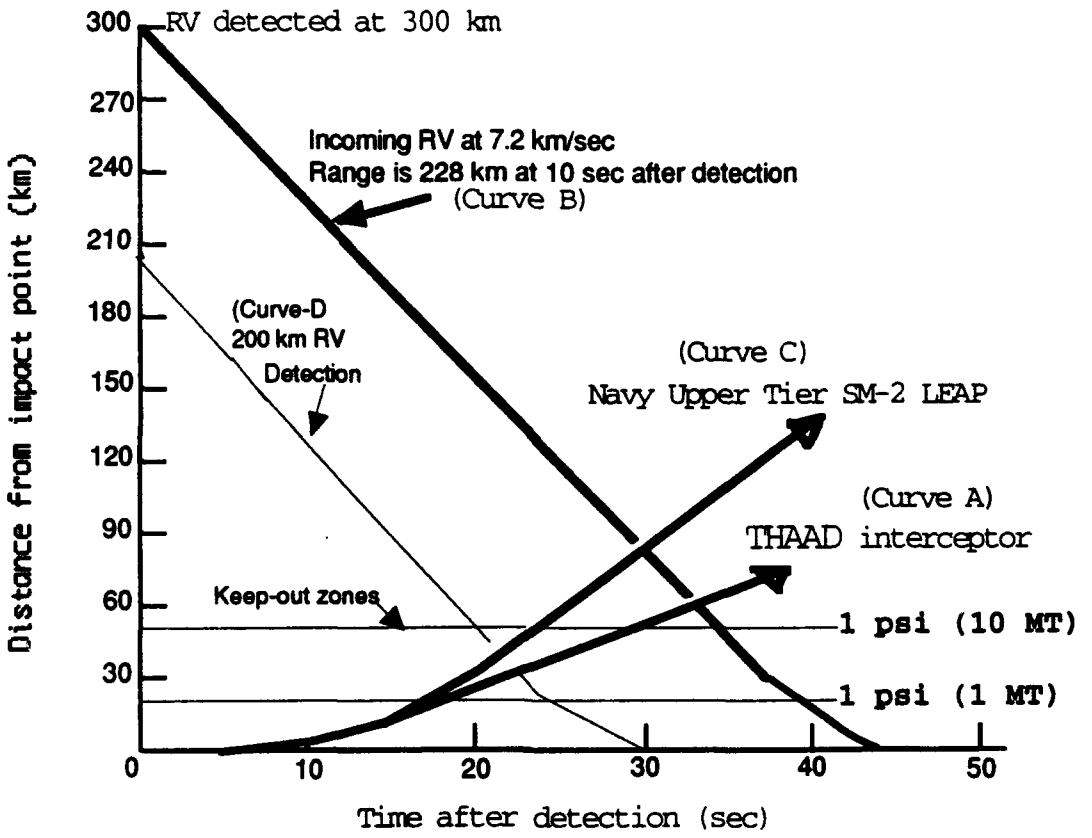

Figure 3: Upper-Tier Interceptors Versus Strategic RV

Note: The assumed speed for the SM-2 Leap is 4.5 km/sec at a 30g acceleration. A five second delay before launch is used for trajectory computations after target detection. Curve-D is added to show [SM-2 LEAP] and THAAD capability at a 200 km RV detection range.

Many analysts seem to believe the Navy's upper tier will be able to defend a larger area than THAAD, but that analysis appears to be dependent on geography.[137]

The Navy's upper-tier system has a significant capability against a strategic ballistic missile based on current estimates of its operating parameters. Figure-3 illustrates the that SM-2 LEAP interceptor is clearly more capable than THAAD when RV detection range is identical. Even at a constrained detection range of 200 km (Curve-D), both interceptors manage to keep the incoming RV outside the one MT keep-out zone. In the final analysis, the Navy Upper-Tier and THAAD interceptors would be effective against all but the largest strategic ballistic RVs.

The future of the Navy upper-tier program is not cast in stone; its very survival may be affected by funding constraints and the ABM capability issue. The funding issue recently surfaced in the BMDO's 1995-1999 budget request that earmarked only $157 million for sea-based upper-tier, instead of the approximately $600 needed to develop the program for eventual deployment.[138] The end result of the funding change

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[137]David Mosher and others, "Theater Ballistic Missile Defenses: Selected Issues," Congressional Budget Office-Staff Memorandum, July 1993, p. 9-10.

[138]Robert Holzer and Barbara Opall, "U.S. Navy Fights BMDO for Antimissile Funds," Defense News, 11 April 1994, p. 8. As if to "add insult to injury," the authors report that the Air Force's BPI program was increased in funding to a level of nearly $500 million through 1999. See also Joseph Lovece, "Theater Missile Defense 'Core' Programs Will Cost $21 Billion," Defense Week, 14 February 1994, p. 1.

has reportedly downgraded the Navy's upper-tier to a demonstration effort instead of an acquisition program.[139] The sea-based upper-tier's prospects for survival are lessened by the recent funding limitations combined with its projected ABM capabilities.

In summary, this evaluation demonstrates a significant capability for the Navy's upper tier TMD to counter strategic ballistic missiles Because the interceptor is projected to have a velocity approximately double that of the THAAD missile, combined with the range and terminal seeker guidance of the LEAP kinetic kill vehicle, the capabilities of this system could constitute a "base" for a nationwide defense of territory. This conclusion is appropriate for two reasons: first, the Navy's use of 5294 Vertical Launch Systems cells on 51 Aegis equipped ships could be perceived as a significant ABM capability that is sea-based, mobile, and supported by long-range sensor assets; and second, because this analysis illustrated THAAD's additional capability against a salvage-fused weapon, it simply recognizes that the Navy's upper tier is significantly more capable against a strategic ballistic missile in a one-on-one engagement. Politically, one could argue that the entire fleet of Aegis cruisers and destroyers would not be

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[139]Barbara Starr, "Navy Waits for TMD funding," Jane's Defense Weekly, 12 march 1994, p. 20. The Navy allegedly needs $180 to keep the program viable this year, but was allocated only $17 million.

equipped with the upper-tier interceptors, and therefore, could not be perceived as a threat to the ABM Treaty. But that argument assumes the Russians would have to agree. In the end, it appears that the sea-based upper-tier is probably the most likely candidate to be perceived as an ABM treaty violation. Deployment of this system would certainly require modification of the treaty.

3. Patriot and Other Lower-tier Defenses

The Patriot missile gained its political reputation during the Gulf war. The badly out-gunned Patriot was "tested in combat" against the relentless Scud missile attacks. Although there is much debate about the efficacy of the Patriot Anti-Tactical Capability-2 (PAC-2)[140] used in the Gulf war, additional improvements from Gulf War lessons learned to the PAC-2 upgrade will be deployed by 1995. Patriot's political fame is accredited for keeping Israel out of the gulf conflict and thereby maintaining the allied coalition.

The Patriot system forms the lower tier component of the Army's High Altitude Theater Missile Defense (HATMD) requirement.[141] Patriot is a point defense system with an

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[140]For negative views of Patriot's effectiveness during the Gulf War, see John Conyers Jr., "The Patriot Myth: Caveat Emptor," Arms Control Today, November 1992, p. 3; and, Joseph Lovece, "Electronic Noise from U.S. Gear Prompted errant patriots," Defense Week, 28 September 1992, p. 1.

[141]W. Fredrick Kilgore, "Theater High Altitude Area Defense," A U.S Army THAAD Project Office White Paper, Huntsville, AL, 4 February 1994, p. 1.

effective footprint radius in the "tens of kilometers" range. The Patriot PAC-3 program is an effort to make the Patriot even more responsive to the ballistic missile threat. Patriot radar improvements will allow greater range and altitude detection--in effect, increase the defensible footprint size over PAC-2. Additionally, the highly maneuverable and inertially guided ERINT interceptor, which employs hit-to-kill kinetic technology, was selected by the Army as the PAC-3 Missile.[142] With expanded detection capability over PAC-2, the PAC-3 footprint is sized as a radius of "several tens of kilometers" or mid-endoatmospheric range. Finally, one of the most important points about lower-tier defenses is that they maintain the capability for defense against aircraft and cruise missiles--in effect to protect the upper-tier defenses and other valuable areas to ensure the viability of the entire theater missile defense.

Can lower-tier defenses form the basis for the development of a nationwide ABM defense of territory? Can the current TMD systems under development in the United States be perceived as having a capability to counter a strategic ballistic missile? If history is a precedent, then the Russians would have cause to adopt "an ABM capable" perception of America's lower-tier TMD development. The United states historically complained that some Soviet TMD

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[142]"Loral Gains Ballistic Missile Upper Hand," Defense Electronics, May 1994, p. 10.

Systems had inherent ABM capabilities and that the Soviets tested them in an ABM mode.[143] For the simplicity of argument, the current United states lower tier systems are plotted in Figure-4 with strategic RV detection ranges of 100, 70, and 40 kilometers.

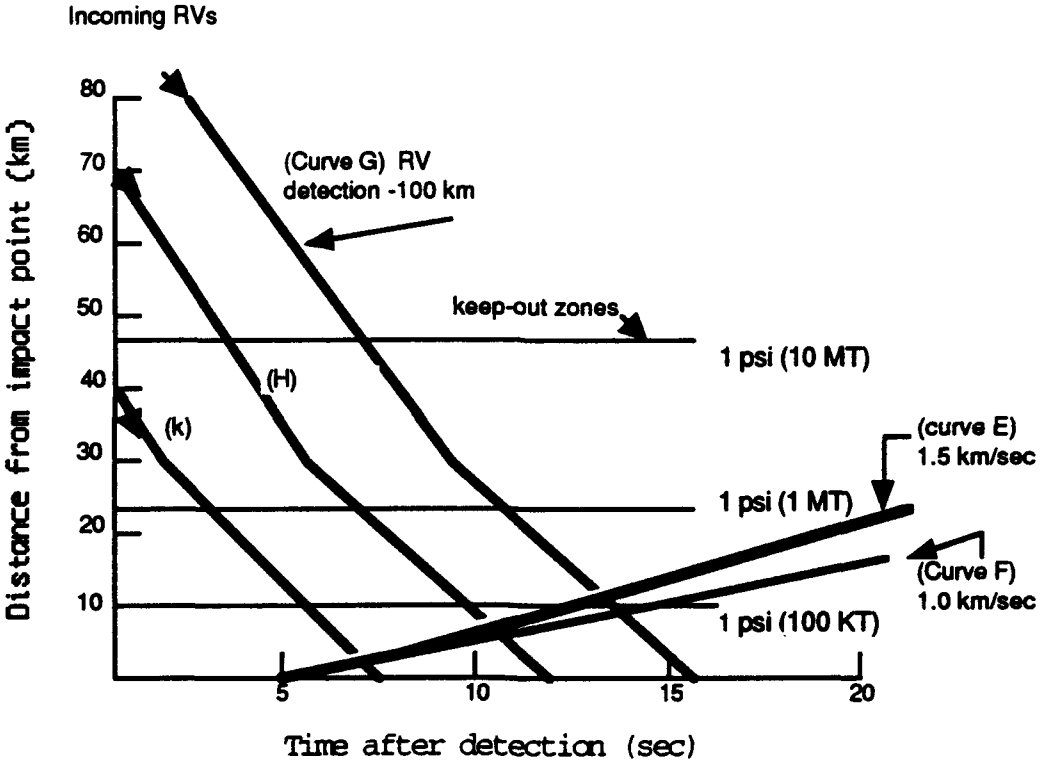

Figure 4: Lower-Tier Interceptors Versus Strategic RV

Notes: The assumed RV detection range is 100 km for a mid endoatmospheric TMD system. Curve (E) represents a Patriot or standard missile type interceptor with a velocity of 1.5 km/sec. Curve (F) more approximates a HAWK type interceptor with a velocity of one km/sec or less. Curves G, H, and K, represents incoming RVs at 100, 70, and 40 km respectively.

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[143]See Matthew Bunn, Foundations for the Future, p. 82; and Brian Dailey and Patrick J. Parker, Soviet Strategic Deception, p. 249. These systems are also alleged to be less capable than Patriot.

The conclusion that is immediately obvious, upon examination of Figure-4, is that the footprint size of the lower tier interceptor is very small and primarily dependent on RV detection range. For RV detection ranges of about 100 km, the lower-tier footprint size is approximately 10-12 kilometers. The relationship appears that an approximate doubling of detection range results in a doubling of footprint size for a ratio of RV to interceptor speed of at least four to one.

Another conclusion drawn from figure-4 is that for ranges approximating 100 km or less, a salvaged-fused weapon of only 100 KT would render the defensive missile system useless for defense against strategic ballistic missiles. Interceptor speed does play a role in footprint size, but as Figure-4 illustrates, it is of a lesser magnitude than RV detection range. One of the common design criteria for all U.S. theater defenses appears to address this RV detection range criteria--external cueing and performance in concert with upper-tier defenses.[144] As detection range improves the lower-tier footprint size could be increased out to the maximum range of the interceptor. With future improvements in interceptor range and performance, the footprint size

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[144]For THAAD, Patriot, and Corps SAM, see W. Fredrick Kilgore, "Theater High Altitude Area Defense Program," P. 2; for Aegis and Patriot external cueing, see Barbara Starr and John Boatman, "US Navy gets into Theater Missile Defense," International Defense Review, June 1993, p. 468.

could be increased to the ranges approaching the 10 MT keep-out zone for one psi avoidance.

For the short-term, lower-tier missile defenses do not present a significant capability to counter strategic ballistic missiles in a population defense role. They could be used for clandestine defense of hardened targets. There is no question that the lower-tier footprint is extremely small by comparison to an upper-tier system, but as advances in technology produce highly accurate kinetic kill vehicles that are externally cued by long range sensors, even the boundary between lower- and upper-tier will become less clear.

4. Boost Phase Intercept

The Air Force is studying several concepts for Boost Phase Intercept (BPI), including lasers and kinetic kill vehicles to counter theater missiles in the boost phase of flight, normally less than one minute. The airborne laser platforms would be satellites, large aircraft, and unmanned aerial vehicles (UAVs).[145] The kinetic kill approaches would consist of: (1) the Air force's Peregrine concept that employs an airborne platform (fighters and/or bombers) equipped with high speed interceptor missiles;[146] and, (2) the

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[145]"US Evaluates Candidates for Boost Phase Intercept," International Defense Review, November 1993, p. 850.

[146]David Hughes, "BMDO Under Pressure to SET TMD Priorities," Aviation Week & Space Technology, 17 January 1994, p. 49.

Responsive Aircraft Program for Theater Operations (RAPTOR), would employ formations of UAVs carrying sensors and TALON (Theater Applications-Launch on Notice) hypervelocity missiles--3.3 km per second--to engage TBMs at ranges of up to 220 km.

The BMDO recently increased the funding profile for BPI in its 1995-1999 budget request, and concomitantly reduced the profile for the Navy's upper-tier and the Corps SAM lower-tier systems. The BPI concept, if technically viable, would represent a serious threat to strategic ballistic missiles as well. If a TBMD system has the capability to counter a tactical ballistic missile in the first few seconds of launch, then it obviously has the ability to also counter a strategic ballistic missile in the boost phase.

If the United States surveys its policy options for deployment of BPI systems, agreements and limitations for their use must be established prior to development. This would reduce the serious possibility of wasteful expenditure of funds on systems that can not be deployed. BPI systems have a significant capability to counter a strategic ballistic missile and to provide a "base" for defense of territory.

B. SUMMARY: TMD, TECHNOLOGY AND TORPEDO STAND-OFF RANGE

This chapter supported the premise that some TMD systems in development or planned by the U.S. might be capable of countering strategic ballistic missiles. The analysis demonstrated that area defense systems, such as the Army's THAAD and the Navy's Upper-Tier are capable of countering a strategic ballistic missile in a one on one engagement. Computer studies were cited that demonstrated THAAD's defensible footprint against a strategic target (with a radar cross section of 0.05 square meters) is approximately 60 kilometers. THAAD does represent a violation of the ABM Treaty because it is capable against a strategic ballistic missile based on the study completed by the Arms Control Association.

In order to make the analysis of TMD capability against a strategic ballistic missile more indicative of actual capability, this chapter used a model that went beyond mere footprint analysis. The model is based on the assumption that a combination of defended TMD footprint area and nuclear blast effects would be more representative of the interaction of a TMD interceptor with a strategic ballistic missile. The model confirmed that THAAD and the Navy Upper-Tier are capable of intercepting, and avoiding the nuclear blast effects of salvaged-fused strategic ballistic missile warhead.

Lower-Tier TMD systems (i.e., Patriot, HAWK, etc.) are not capable against a strategic ballistic missile; moreover, these systems can not avoid the nuclear blast effects. Boost phase systems are inherently capable against a strategic ballistic missile if they can counter a theater ballistic missile; they are an obvious violation of the ABM Treaty.

The argument often used by proponents of TMD is that admittedly THAAD and the Navy Upper-Tier would have some capability against a strategic ballistic missile in a very controlled situation, but only in a military sense without political intent. **This chapter has shown and I contend that the ABM Treaty is apolitical; any military capability is assumed to be an ABM capability.** The treaty must be changed in order to address the technological progress made in missile defense.

The technological prowess of ballistic missile defense in the 1990s is superior to that of the 1960s and 1970s. Some of the technological advances of the 1980's "Star Wars" era are now incorporated in today's theater defense systems. Advances such as kinetic kill vehicles, that employ onboard infrared seekers and LEAP technology are all offshoots of the "Star Wars" research. THAAD and ERINT are both hit-to-kill interceptors that employ these technologies. The Navy's upper-tier is slated to make use of the LEAP technology for greatly increased range. Some estimates put the range of the LEAP kill vehicle, alone, in the range of hundreds of

kilometers.[147] General Horner recognized the revolution in technology and external cueing when he recently said:

> What happened is that in Operation "Desert Storm" everyone became aware of the revolution in warfare....the use of space-based assets played a major role in making that happen. The key goal of the Space Command is to develop ways to get satellite cueing, targeting, and communications information directly into the cockpits and ships.[148]

The use of space or air-based assets is assumed in future U.S. conflicts.

The revolution in torpedo technology presents an historical analogy to the revolution in ballistic missile defense. During World War II, submarine commanders had to approach targets to within a 1000 to 1500 yards to ensure a hit. The straight running torpedoes of that period were essentially, little more that point and shoot weapons. The short range was necessary to reduce target solution errors to the point necessary for a hit. Following World War II the Superpowers introduced two innovations: the nuclear tipped and acoustic torpedoes. Nuclear torpedoes would solve the solution accuracy problem--just point and shoot at long range. Acoustic torpedoes and better ship mounted sonar drastically improved target detection range and,

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[147]Jane's Strategic Weapon System, 1990, Surrey, UK., s.v. "Missile Defenses."

[148]Interview between General Charles Horner, U.S. Space Command and Barbara Starr in Jane's Defence Weekly, 19 March 1994, p. 32.

consequently, increased submarine standoff range by approximately a power of magnitude over World War II values.

Today's ballistic missile defense evolved through much the same process from the old days of the Nike Hercules--nuclear tip point and shoot missiles--to today's technology of missile mounted sensors, kinetic kill vehicles, and external cueing. In effect, the solution accuracy problem no longer diminishes the standoff range to the point of creating an unacceptable danger to the defender. Of course, these systems are still vulnerable to countermeasure, but it appears that solving the problem of hitting the incoming missile is, as much a part of history, as the straight running torpedo.

IV. ARMS CONTROL STRUCTURE

The arms control structure is a phrase often used to refer to the current and past results of the efforts between the United States and the former Soviet Union to negotiate strategic arms control agreements. The structure is perceived to be represented by the various arms control agreements, such as the Strategic Arms limitation Talks (SALT) and the Strategic Arms Reduction Talks (START), that supposedly enhance the quest for strategic stability.

Are views of the arms control structure and the quest for strategic stability perceived differently by the United States and the former Soviet Union? Scholars and officials associated with the arms control process cite different motives of the superpowers for involvement in the arms control process: first, for the United States, arms control is a technical exercise in managing and reducing the threat posed by aggressive or destabilizing "capabilities"; and, second the former Soviet Union views arms control as an exercise in managing political threats, reducing aggressive or destabilizing "intentions," and obtaining strategic advantage.[149] Whether "intentions" or "capabilities"

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[149]See Kerry M. Kartchner, Negotiating Start, New Brunswick, Transaction Publishers, 1992, p. 2; and Brian D. Dailey and Patrick J. Parker, Soviet Strategic Deception, p. 226-227.

permeated the motives for strategic stability between the United States, and now, Russia, the arms control structure is perceived today as the best method to reach strategic stability.

This section will examine the ABM treaty as it relates to the arms control structure. Since the ABM Treaty is perceived as the *sine qao non* of strategic offensive deterrence, its demise may adversely affect the arms control structure and accelerate a global shift in strategic deterrence form offensive to defensive.

A. THE ABM TREATY AND THE ARMS CONTROL STRUCTURE

The ABM Treaty appears to be the foundation upon which arms control is constructed. Matthew Bunn called it "the centerpiece of strategic arms control and a bulwark of U.S. national-security."[150] The 24 year old accord was signed by the United States and the Soviet Union in May, 1972. The United States and the Soviet Union also signed the Interim Agreement on strategic offensive arms at the same time. The so-called SALT I accords thus contained two parts: (1) offensive--Interim Agreement on Offensive Weapons, and (2)

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[150]The title of Bunn's book describes his reverence for the ABM Treaty. See Matthew Bunn, Foundation for the Future: The ABM Treaty and National Security, p. 4.

defensive--the ABM Treaty.[151] Figure-5 illustrates the ABM Treaty and how it forms the basis for and supports the arms control structure.

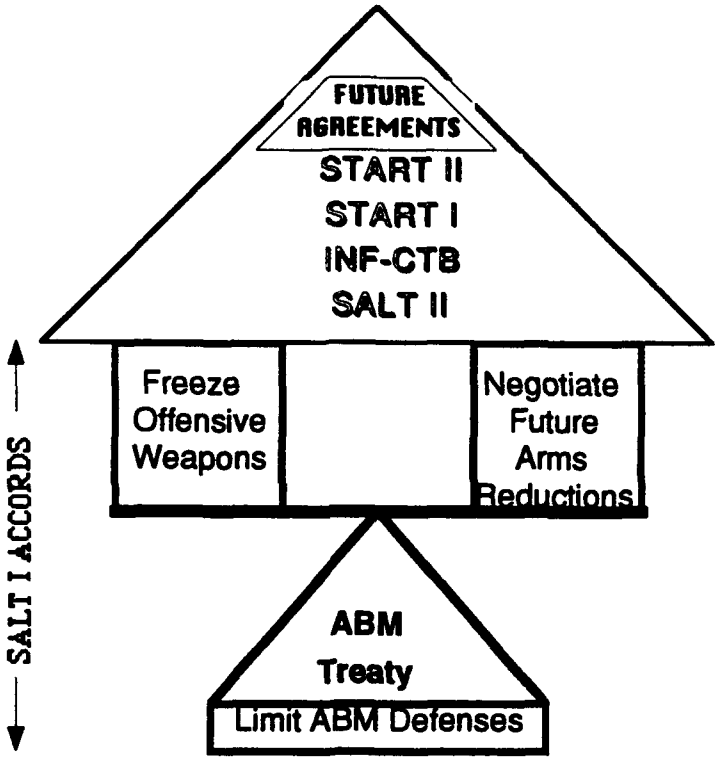

Figure 5. The ABM Treaty & the Arms Control Structure

The negotiation of limitations on defensive and offensive arms was closely linked. Under the Interim Agreement, both

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[151]Teena K. Mayers, Understanding Weapons and Arms Control: A guide to the issues, Washington, D.C., Maxwell Macmillan-Pergamom Publishing Corp., 1991, 4th ed. Rev., p. 109-110.

sides were permitted to expand their sea-based missile forces only if they dismantled an equal number of older land or sea-based missile launchers.[152] Both countries agreed to follow up the Interim Agreement with active negotiations for more comprehensive limitations in the arms race. Thus the Interim Agreement was a holding action to compliment the ABM Treaty, to limit competition in offensive weapons, and to provide a framework for further negotiations.[153]

The ABM Treaty provided the physical constraints on ballistic missile defense systems so that limits on current offensive arms could be obtained. Moreover, the Interim Agreement allowed for on-going negotiations for future offensive arms reduction. Thus, the ABM Treaty formed the basis of the arms control measure adopted concurrently and labeled as the Interim Agreement on Offensive Weapons or SALT I. The follow-on arms control Agreements such as SALT II, the INF Treaty, START I and II have actually led to bilateral arrangements, not just for offensive arms limitations, but offensive arms reduction. The ABM Treaty thus forms the basis for follow-on arms control agreements that constitute the arms control structure. One noted author actually

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[152]Ibid.

[153]Ibid.

describes the success of START as "the latest triumph of the ABM Treaty."[154]

B. EFFECTS OF A WEAKENED ABM TREATY

A weakened or ignored ABM Treaty would not be conducive to the maintenance of the arms control structure. Since the ABM Treaty forms the foundation for the restraint of strategic defensive missile systems between the United States and states of the former Soviet Union, the continued reductions in strategic offensive missiles would be in jeopardy. There is a genuine danger that START will not be implemented, and a virtual certainty that the opportunity to reduce even further the number of offensive nuclear weapons will be foreclosed.[155] Other United States arms control objectives would also be in jeopardy: (1) a continued moratorium on nuclear testing and negotiation of a Comprehensive Test Ban; and, (2) continued opposition to further nuclear proliferation.[156] Finally other nuclear powers such as France, United Kingdom, Israel, may perceive their strategic offensive missiles as inadequate and generate further regional arms races. The regional arms race phenomenon is particularly relevant, dangerous, and complex

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[154]Paul C. Warnke, "Success Linked to ABM Treaty," The Bulletin of the Atomic Scientists, November 1991, p. 18.

[155]Ibid.

[156]Steve A. Hildreth, "The ABM Treaty and Theater Missile Defense: Proposed Changes and Potential Implications," P. 21.

between Israel and her Arab neighbors.[157] One possible secondary effect of regional arms races may be the proliferation of missile defensive systems to offset the increase in offensive missiles.[158]

Non-adherence to the ABM treaty by the United states and Russia may not result in an immediate offensive arms race between the two countries. Russia's depressed economy is not in a position to support an offensive arms race for the short term. In the long run, the so-called Russian nationalist sentiment could again raise fears of an offensive arms competition.[159] The immediate effect of non-adherence to the ABM Treaty is that proliferation of defensive missile systems could block the unprecedented opportunity to reduce strategic forces.[160] It appears that the "ABM as a symbol of the arms race" described by Robert S. McNamara, in 1965, equally

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[157]See Robert E. Looney, "Arms Races in the Middle East: A Test of Causality," Arms Control, September 1990, p. 178. Dr. looney's main finding in this study was that suppressing increases in Israeli defense expenditures is the most effective way of reducing militarization in the region.

[158]Alvin Toffler and Heidi Toffler, War and Anti-War, Little, Brown and Company, Boston, Mass., 1993, p. 102.

[159]Steven Erlanger, "U.S. Agrees to Postpone Joint Exercises in Russia," The New York Times, 1 June 1994, A4. See also McGeorge Bundy, William J. Crowe, and Sidney D. Drell, Reducing Nuclear Danger: The Road Away from the Brink, New York, Council on Foreign Affairs, 1993, p. 41.

[160]Gerard C. Smith, "Two Decades Later: The ABM Treaty in a Changed World," Arms Control Today, May 1992, p. 3.

influences offensive arms reduction in the same negative manner as an arms build-up.[161]

The above view of the effects of the ABM Treaty assumes the action-reaction phenomenon in arms acquisition among competitive nations. The negative perspective of the ABM and the SALT process denies that the ABM Treaty had any effect on the offensive arms acquisition during the 1970s and 1980s. The following quote by Brennan is illustrative of ABM Treaty opponents:

> The one thing that is most certain about this Soviet buildup is that, if we had gone ahead with the 'Safeguard' BMD System to protect Minuteman as proposed in 1969, every one of the critics of BMD would today be blaming that Soviet buildup on our Safeguard deployment. I am therefore tempted to claim that the most constructive result of the 1972 ABM treaty is that it unambiguously demolished this explanation for the Soviet buildup, the rate of which increased in the aftermath of SALT I.[162]

The main point of the opposing view is that the history of arms buildup following SALT I demonstrates that the Soviets have often marched to their own drum. The United States mistakenly believed it understood Soviet intentions and objectives during SALT I, and therefore, erroneously attributed arms reduction to the ABM Treaty.

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[161]Morton H. Halperin, "The Decision to Deploy the ABM: Bureaucratic and Domestic Politics in the Johnson Administration," Foreign Affairs, October 1972, p. 73.

[162]Donald G. Brennan, "BMD Policy Issues for the 1990s," in William Schneider, Jr. and others, "U.S. Strategic-Nuclear Policy and Ballistic Missile Defense: The 1980s and Beyond, a special report, Institute for Foreign Policy Analysis, Cambridge, Mass., 1980, p. 30. See also Gerard Smith, Double Talk, p. 472.

Finally, if highly effective ABM systems were deployed, the whole concept of strategic nuclear deterrence would be eroded. The shift to a defensive and damage limiting posture is very appealing, because it extols the virtue of human lives saved instead of mere acquiescence to nuclear weapons destruction. President Reagan's call to "render nuclear missiles impotent and obsolete" exemplifies the attraction of ballistic missile defenses.[163] Real world situations would probably result in a mix of strategic offensive missiles and ABM defenses, but the effect on strategic stability is uncertain.[164] Perhaps the greatest danger in a transition from offensive deterrence to a combination of offense-defense strategy would be the uncertain effect on strategic stability.

The current arms control structure produces an element of predictability, and the reluctance to give up that predictability in exchange for the uncertainty that the absence of the treaty would bring has no doubt helped to keep it in force.[165]

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[163]See the series on "Weapons in Space," The New York Times, 3-8 March 1985.

[164]Interview between Baker Spring, The Heritage Foundation, and the Author, 29 April 94.

[165]George Schneiter, "The ABM Treaty Today," in Aston B. Carter and David N. Schwartz, eds., Ballistic Missile Defense, p. 243.

V. PROSPECTS FOR THE FUTURE

The future of TMD as envisioned by the Department of Defense is problematic at best. Obstacles that have to be overcome include: (1) TMD ambiguities contained in the ABM Treaty; (2) amendments or clarification proposed to change the treaty; (3) funding restraints; (4) multilateralization and, (5) traditional opponents of ballistic missile defense.

The ABM Treaty is argumentatively one of the most respected and despised documents ever written. Arms control proponents believe it served to halt the strategic arms race between the superpowers and is ever deserving of reverence.[166] Critics view the treaty as an outdated document that restricts the development of defenses needed to counter ballistic missile proliferation.[167] One area of agreement among critics and proponents is the need for changes to the ABM Treaty. It is those needed changes that add to imprecise phrases and undefined terms and create ambiguity in the treaty. The lack of clarity in this extraordinary brief

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[166]See Gerard C. Smith, "Two Decades Later: The ABM Treaty in a Changed World," Arms Control Today, May 1992, p. 3; Matthew Bunn, Foundation for the Future, p. 4.

[167]See Theresa Hitchens, "Treaty Rewrite Would Bolster Tactical Defenses," Defense News, 20 December 1993, p. 4; Interview between Baker Spring, The Heritage Foundation, and the author, 29 April 1994; and, Interview between William loomis, Lockheed Missiles & Space Co., and the author, 29 April 1994.

document will not aid the restraint and control of TMD systems. Additionally, the efficacy of the ABM Treaty will remain in question until the inherent ambiguities are resolved.

The ABM Treaty has not been changed or clarified for 12 years.[168] The Clinton administration made a proposal through the SCC and the Russians to clarify the Treaty. This proposal created much controversy among the arms control community and the Russians because it was perceived as too liberal in TMD restrictions. The arms control community assert that the proposed TMD demarcation line established at a system capability to intercept an incoming theater missile target traveling five km/sec or less exceeds the requirements for theater defensive capability; moreover, a limit of five km/sec for TMD designation will allow significant capability against a strategic ballistic missile as well.[169] The Russians reportedly acknowledged that both sides need to develop TMD systems to defend against missiles with ranges up to 3500 km, but argued that the single criteria of velocity was insufficient.[170] The United States rejected a Russian

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[168]Sidney N. Graybeal, Testimony Before the Senate Foreign Relations Committee on Effective Theater Missile Defenses and the ABM Treaty, 3 may 1994.

[169]Dunbar Lockwood, "U.S. Proposal to Retool ABM Treaty Reopens Debate on Missile Defense," Arms Control Today, January/February 1994, p. 24.

[170]Ibid.

counter-proposal of concomitantly restricting interceptor missile speed to three km/sec. The prospects for the needed changes to the ABM Treaty remain bleak for the short-term. A scheduled meeting of the SCC in June has been postponed indefinitely.[171]

TMD funding restraints are significant when overall program cost are considered. A recent study conducted by the Congressional Budget Office revealed that the BMDO could adequately fund only two of the three core TMD programs slated for development through 1999.[172] The THAAD and Patriot were fully funded, under the study assumptions, but the Navy lower-tier was not. Another complicating factor was that BMDO's FY1995-1999 funding level was reduced from $18 to $17 billion by the Department of Defense (DOD). All sectors of the Department of Defense are affected by the declining budget in the post Cold War era. The future does not hold promise for increased program funding levels, but the funding profile for most TMD programs appears to be up. Table V illustrates estimated life-cycle costs for various TMD programs. Costs estimates are usually understated in the research and development phases of DOD programs. That premise is supported by the range of the figures in Table V

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[171]Interview between Major Ward, Ballistic Missile Defense Organization, Office of Deputy for Strategic Relations, Washington, D.C., and the author, 23 May 1994.

[172]David Mosher and others, "Theater Ballistic Missile Defenses: Selected Issues," Congressional Budget Office CBO Staff Memorandum, July 1993, p. 16.

which are higher than previous estimates.[173] The higher estimates usually are not from DOD officials.

TABLE V: TMD LIFE CYCLE COSTS (THEN YR. DOLLARS)

System	Cost
THAAD	$12-14.9 billion
Patriot PAC-2	$2 billion
Patriot PAC-3	$3.2 billion
Navy LT	$2-4 billion
Navy UT	$4-5 billion
Corps SAM	$8-15 billion
Brilliant Eyes	$5 billion

Source: Statement of Brad Hathaway, General Accounting Office, Before the Committee on Foreign Relations U.S. Senate, 3 May 1994, GAO/T -NSIAD-94-167, P. 4-5; Joseph Lovece, "Theater Missile Defense 'Core' Programs will Cost $21 Billion," Defense Week, 14 February 1994, p. 1; and "Missile Defense Centerpiece weapon to Cost $17 Billion," Defense Week, 22 February 1994, p. 1.

The Navy is contesting a significant BMDO funding reduction in the Aegis upper-tier system. This comes at a particularly bad time because the Navy faces a budget shortfall of roughly $3.5 billion per year in FY95-99.[174]

The ABM Treaty is a bilateral instrument between the United states and the former Soviet Union. Many of the states of the former Soviet Union, in addition to Russia, have committed themselves to fulfill the provisions of the ABM Treaty and to include all the necessary agreements with

[173]Joseph Lovece, "Missile Defense Centerpiece Weapon To Cost $17 Billion," Defense Week, 22 February 1994, p. 1.

[174]John Boatman, Interview with Rear Admiral Philip Quast, Director US Navy Surface Warfare Division, Jane's Defense Weekly, 12 February 1994, p. 32.

the United States.[175] This would make changes to the treaty much more difficult than they already are. Moreover, the United States said it was prepared to multilateralize the treaty.[176] Other problems associated with multilateralization include Soviet ABM radars located in Latvia and Azerbaijan that raise ABM compliance issues. In summary, multilateralization appears to be an unnecessary and unworkable complication to the ABM Treaty.[177]

The opponents and supporters of BMD still exist along the same lines as in the Reagan "Star Wars" era. It appears that the effort to reduce funding for missile defenses, whether theater or national variety, will continue for the foreseeable future.

The basic position taken by those who support ballistic missile defense is that: (1) we need TMD to protect our allies and troops deployed overseas in future theater conflicts where ballistic missiles may be used; (2) we need a limited national ballistic missile defense to protect the continental United States from accidental missile launch by Russia or a future outlaw state that is projected to obtain ICBM capability; (3) we need TMD to discourage global

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[175]Jack Mendelsohn, "A New Threat to the ABM Treaty: The Administration's TMD Proposal," Arms Control Today, January/February 1994, p. 12.

[176]Ibid.

[177]Interview between Baker Spring and the author, 29 April 1994.

ballistic missile proliferation; (4) the restructured ballistic missile defense program is renamed, ground-based vice space-based, conforms to the 1972 ABM Treaty, realistic, and more properly meets the threat of global ballistic missile proliferation.[178]

The position taken by those who oppose BMD is that: (1) the nation has spent too much money on BMD with nothing to show for it--some $30 billion to date; (2) Theater defenses are a waste of time and effort; even a fool-proof system will not defend against cruise missiles. (3) a national missile defense system will not defend against weapons of mass-destruction delivered by personnel or vehicles other than missiles such as boats, helos, car, train, etc.; (4) the development of BMD is technologically unsound as evidenced by alleged falsification of SDI missile experiments, in 1984, to make the program appear more successful than it really was;[179] (5) the new Ballistic Missile Defense Organization (BMDO) is just "Star Wars" renamed to include the Patriot upgrade for TMD; there is considerable doubt about the performance of Patriot during the gulf war, so maybe some technical problems remain in solving the ballistic missile threat; (6) the ballistic missile defense program has too many TMD programs and we can't afford them all; we are spending more on BMD

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[178] Congressional Record, 8-9 September 1993, 11092-11100.

[179] Tim Weiner, Aspin Says Inquiry Is Set On 1984 "Star Wars" Test, New York Times, 19 August, 1993, A1.

than any other weapons program; deficit reduction will eventually reduce the funding profile; (7) spending funds on the National Ballistic Missile Defense program is not necessary, because the threat is not near-term; (8) the U.S. deployed an ABM system in the mid 1970s and closed it 30 days later--why repeat the process. Obviously, the ABM debate will continue, but Congress appears willing, for the short term, to allow the Clinton administration to take a position before changing the funding profile drastically.

VI. CONCLUSION

At the outset of this analysis I proposed that current plans for TMD development and deployment posed serious U.S. policy questions: first, how ambiguous is the ABM Treaty in relation to TMD systems? Second, do current U.S. TMD programs possess capabilities to counter strategic ballistic missiles? Third, will the lack of a demarcation line between TMD and ABM systems in the treaty prohibit TMD systems from acquiring a capability against a strategic ballistic missile? Fourth, what are the implications for the global arms control structure for an abrogated ABM Treaty? Fifth, are technological advances in TMD sensors, missile interceptors, radar, and external cueing available to TMD systems out pacing the ABM Treaty?

The ABM Treaty is unclear in relation to TMD development and deployment. Some of the ambiguities in the treaty text were supposedly clarified at the treaty signature process by three attachments labeled as Agreed Statements, Common Understandings, and Unilateral Statements. Since the majority of the attachments to the treaty were written against the first six articles of the treaty, an improved clarity of understanding between the two parties to the treaty would be a logical assumption. This thesis demonstrates that the Treaty remains ambiguous in the same

general area that was supposedly clarified 22 years ago. Although the brevity of the ABM Treaty text (approximately four pages) does not indicate ambiguity, the text length of the three **attachments** to the treaty **exceeds the Treaty** text. By comparison, the START I Treaty is two orders of magnitude longer than the ABM Treaty at approximately 250 pages of text. The ABM Treaty has not been changed or updated in 12 years and it remains ambiguous in relation to TMD development.

Some TMD systems planned by the United States are capable of countering a strategic ballistic missile. There are many assumptions associated with measuring the capability of a TMD system to counter a strategic ballistic missile. The analysis used herein assumed that the combination of the defended TMD footprint area and nuclear blast effects would be more representative of the interaction of a TMD system with a strategic ballistic missile. The Army's THAAD system and the Navy's upper-tier are capable of intercepting, and avoiding the nuclear blast effects of a salvaged-fused strategic ballistic missile warhead. These two systems will probably represent a violation of the ABM Treaty as it is currently written. The defended footprint of lower-tier systems is satisfactory against a conventionally armed ballistic missile, but would not avoid the nuclear blast effect of a salvaged-fused strategic ballistic missile. If Boost Phase Intercept systems are capable of intercepting

theater ballistic missiles in the first few minutes of flight, then they are also capable of intercepting strategic ballistic missiles. Boost Phase systems represent the clearest violation of the ABM Treaty.

The lack of a clear distinction between TMD and ABM systems in the treaty does not prohibit American TMD systems from acquiring a capability against strategic ballistic missiles. Because TMD systems are not defined in the treaty, their development is dependent on the **functional definition** of not "being given the capability to counter a strategic ballistic missile." The Clinton administration's recent SCC proposal to clarify the treaty, if accepted, would provide a demarcation between strategic and theater defensive missile systems. The proposal appears to cloud the issue further by recommending that a theater defense system can be labeled as a TMD system, as long as it is not tested against a target traveling greater than five km/sec. A TMD system that is capable against a five km/sec target also has some capability against a strategic target traveling at six to seven km/sec. The future of the THAAD flight test program is in question because of uncertainties in the maximum target speed permitted by the ABM Treaty. Additionally, the Clinton proposal raises the "capability versus intent" argument that was often rebuked by the U.S. when used by the Soviets.

The ABM Treaty is viewed by the United States and Russia as the foundation for the arms control structure. If the ABM

Treaty is perceived as ineffective in controlling the ABM capabilities of TMD systems, the prospects for scheduled arms reductions between the two nuclear Superpowers are not good. The arms control implications for other nuclear powers are equally uncertain. If Israel installs a TMD that is capable of protecting the entire country from ballistic missile attack, the Arab calculation of their offensive ability may generate arms race incentives. The reverse is true if the Arabs decide to install TMD area defense systems that are ABM capable against Israel's offensive missiles. Similar regional escalation in arms production can be envisioned for other nuclear powers such as France, India, China, or Britain. Continuation of the Nuclear Test Ban would be problematic under these circumstances.

Advancements in missile defense technology stretch the ABM Treaty's functional definition of "capability to counter a strategic ballistic missile." Improvements in ballistic missile defense capability are strikingly comparable to improvements made in submarine torpedo stand-off range since World War II. Today's TMD uses Hit-To-Kill technology, missile mounted infrared seekers, highly maneuverable missile interceptors, and available external cueing. These technological advancements make the capability argument obsolete. It is no longer a question of capability to counter a strategic ballistic missile, but how should new technological functions of ballistic missile defense be

addressed in the ABM Treaty. Since the functional definition of "capability" in the treaty is being expanded by improvements in technology, if the treaty is not modified, "capability" will no longer be an adequate measure of an ABM function.

Funding restraints represent a major obstacle to TMD development beyond THAAD, Patriot, and the Navy lower-tier. Unless radical changes are made in the BMDO budget profile, even the core programs may not be fully funded. The prospects for the technology demonstration programs such as Navy upper-tier, Corps SAM, and Boost Phase systems are not promising at an aggregate life cycle cost estimate of $12 to $20 billion (excludes Boost systems).

Although the ABM Treaty is ambiguous in the area of TMD, efforts to clarify the distinction between ABM and TMD in the treaty probably will not be successful. The proposed clarification presents only a single standard for TMD determination, and even that is criticized as permitting TMD performance that is capable against a strategic ballistic missile. In short, the ABM Treaty is not likely to be changed to address the problems, but radical TMD development and deployment will be controlled more by budgetary restraint instead of treaty restrictions.

BIBLIOGRAPHY

Anderson, Jack. "Soviet Missile May Be Peril to US Weapon," Washington Post, April 5 1983.

Beal, Clifford. "Racing to Meet the Ballistic Missile Threat." International Defense Review. March 1993.

Boatman, John. "Interview with Rear Admiral Philip Quast." Director US Navy Surface Warfare Division. Jane's Defense Weekly. 12 February 1994.

Brauch, Hans G. ed. Star Wars and European Defense. New York, St. Martin's Press, 1987.

Brennan, Donald G. "BMD Policy Issues for the 1990s." in William Schneider, Jr. and others. "U.S. Strategic-Nuclear Policy and Ballistic Missile Defense: The 1980s and Beyond. a special report. Institute for Foreign Policy Analysis. Cambridge, Mass., 1980.

Bundy, McGeorge, William J. Crowe, and Sidney D. Drell. Reducing Nuclear Danger: The Road Away from the Brink. New York, Council on Foreign Affairs, 1993.

Bunn, Matthew. Foundation for the Future: The ABM Treaty and National Security. The Arms Control Association. Washington, D.C., 1990.

Carey, John E. "Fielding a Theater Ballistic Missile Defense." Proceedings. June 1993.

Carter, Ashton B. and David N. Schwartz. (eds) Ballistic Missile Defense. Brookings Institute. Washington, D.C., 1984.

Cook, Nick. "France, USA Lead the Way With TMD Talks." Jane's Defence Weekly. 19 March 1994.

Congressional Record. 8-9 September 1993. 11092-11100.

Congressional Record. 9 September 1993. S11248.

Conyers, John, Jr. "The Patriot Myth: Caveat Emptor." Arms Control Today. November 1992.

Dailey, Brian D. and Patrick J. Parker. (eds) Soviet Strategic Deception. Hoover Institution Press. Lexington, Mass., 1987.

Department of Defense. "Soviet Strategic and Space Programs." Government Printing Office. Washington, D.C., 1990.

Department of Defense. Soviet Military Power. Government Printing Office. Washington, D.C., 1982.

Durch, William J. The ABM Treaty and Western Security. Ballinger Publishing Company. Cambridge, Massachusetts. 1988.

Erlanger, Steven. "U.S. Agrees to Postpone Joint Exercises in Russia." The New York Times. 1 June 1994.

Foley, Theresa. "DSP Advocates, Foes Cite Dhahran Scud Attack." Space News. 18 April 1994.

Garthoff, Raymond L. "Correspondence: On Negotiating with the Russians." International Security. Summer 1977.

_____. Policy Versus the Law: The Reinterpretation of the ABM Treaty. The Brookings Institute. Washington, D.C., 1987.

Glasstone, Samuel (ed) The Effects of Nuclear Weapons. United States Atomic Energy Commission, Washington, D.C., 1962.

Graybeal, Sidney N. and Patricia McFate. "Redefine Theater Defense." Defense News. 15 November 1993.

Graybeal, Sidney N. Testimony Before the Senate Foreign Relations Committee on Effective Theater Missile Defenses and the ABM Treaty. 3 may 1994.

Gronlund, Lisbeth and others. "Highly Capable Theater Missile Defenses And the ABM Treaty." Arms Control Today. April 1994.

Halperin, Morton H. "The Decision to Deploy the ABM: Bureaucratic and Domestic Politics in the Johnson Administration." Foreign Affairs. October 1972.

Hathaway, Brad. "Ballistic Missile Defense." Testimony Before the Committee on Foreign Relations, United States Senate. General Accounting Office. Washington, D.C., GAO/T-NSIAD-94-167. 3 May 1994.

Hildreth, Steven A. "The ABM Treaty and Theater Missile Defense: Proposed Changes and Potential Implications." U.S.

Library of Congress, Congressional Research Service. Report 94-374F. 2 May 1994.

Hitchens, Theresa. "Treaty Rewrite Would Bolster Tactical Defenses." Defense News. 20 December 1993.

Hitchens, Theresa and Barbara Opall. "THAAD May Be Treaty Debate Fulcrum." Defense News. April 11 1994.

Holzer, Robert and Barbara Opall. "U.S. Navy Fights BMDO for Antimissile Funds." Defense News. 11 April 1994.

Hughes, David. "Aegis Ships to Fill Two-Tier Antimissile role." Aviation Week & Space Technology. 7 June 1993.

_____. "BMDO Under Pressure to Set TMD Priorities." Aviation Week & Space Technology. 17 January 1994.

_____. "Army Selects ERINT Pending Pentagon Review." Aviation Week & Space Technology. 21 February 1994.

Hull John and, Andrew W. Hull. "Motivations for Producing Ballistic Missiles and Satellite Launch Vehicles." Jane's Intelligence Review. February 1993.

Interview between John Pike. Director of the Space policy Project. The Federation of American Scientist. Washington, D.C., and the Author. 21 April 1994.

Interview between Baker Spring. The Heritage Foundation, and the Author. 29 April 94.

Interview between William Loomis, Vice-President, Defensive Missile Systems. Lockheed Missiles & Space Co. Sunnyvale, CA., and the author. 29 April 1994.

Interview between Baker Spring. The Heritage Foundation. Washington, D.C., and the author. 17 May 94.

Interview between Sidney Graybeal. Senior Scientist. Science Applications International. Mclean, VA., and the Author. 23 May 1994.

Interview between Major Ward. Ballistic Missile Defense Organization. Office of Deputy for Strategic Relations. Washington, D.C., and the author. 23 May 1994.

Kartchner, Kerry M. Negotiating Start. New Brunswick, Transaction Publishers, 1992.

Kilgore, Fredrick W. "Theater High Altitude Area Defense Program." A U.S. Army White Paper. THAAD Project Office. Huntsville, AL., 4 February 1994.

Krepon, Michael. "Effective Theater Missile Defense Need not Undermine ABM." Defense News. 14 February 1994.

Lennox, Duncan. (ed) Jane's Strategic Weapon Systems. Jane's Information Group. Surrey, UK, 1990.

_____. "Battling With the Ballistic Threat." Jane's Defense Weekly. 20 March 1993.

Lin, Herbert. New Weapon Technologies & the ABM Treaty. Pergamon-Brassey's International Defense Publishers. Mclean, VA., 1988.

Lockwood, Dunbar. "U.S. Proposal to Retool ABM Treaty Reopens Debate on Missile Defense." Arms Control Today. January/February 1994.

_____. "Senators Appear Skeptical of ABM Treaty Modifications." Arms Control Today. April 1994.

_____. "U.S. Rejects Moscow's Proposal To Limit ATBM Interceptor Speeds." Arms Control Today. May 1994.

Lok, Joris J. "USN Prepares 'Make or Break' LEAP tests." Jane's defense weekly. 23 April 1994.

Looney, Robert E. "Arms Races in the Middle East: A Test of Causality." Arms Control. September 1990.

"Loral Gains Ballistic Missile Upper Hand." Defense Electronics. May 1994.

Lovece, Joseph. "Electronic Noise from U.S. Gear Prompted errant patriots." Defense Week. 28 September 1992.

_____. "Missile Defense Budget Avoids Making the Hard Choices." Defense Week. 8 February 1994.

_____. "Theater Missile Defense 'Core' Programs Will Cost $21 Billion." Defense Week, 14 February 1994.

Mayers, Teena K. Understanding Weapons and Arms Control: A guide to the issues. Washington, D.C., Maxwell Macmillan-Pergamom Publishing Corp., 1991.

Mosher, David. "Theater Ballistic Missile Defenses: Selected Issues." Congressional Budget Office Staff Memorandum. Washington, D.C., July 1993.

Munro, Neil and Vago Muradian. "U.S. View On ABM Treaty May Kill Programs." Defense News. 16 August 1993.

Newhouse, John. Cold Dawn: The Story of SALT. Holt, Rinehart and Winston. New York, 1973.

Opall, Barbara "ABM Policy Shifts Imperil Clinton's Military Strategy," Defense News, 4 October 1993,

_____. "Strategic Accord Inhibits Advances In TMD Programs." Defense News. 4 October 1994.

Palmer, Elizabeth A. "Clinton Hews to Narrow View On ABM Treaty." Congressional Quarterly. 17 July 1993.

Pike, John. "A New Threat to the ABM Treaty: The Administration's TMD proposal." Arms Control Today. January/February 1994.

Protocol to the Treaty Between The United States of America and The Union of Soviet Socialist Republics On the Limitation of Anti-Ballistic Missile Systems. July 3, 1974. United States Treaties 1645, TIAS no. 8276. Government Printing Office, Washington, D.C., 1974.

Report to Congress on the Strategic Defense Initiative. Department of Defense. Washington, D.C., 1989.

Report to Congress on the Strategic Defense Initiative. Strategic Defense Initiative Organization (SDIO). Washington, D.C., 1993.

Rhinelander, John. "A New Threat to the ABM Treaty: The Administration's TMD Proposal." Arms Control Today. January/February 1994.

Schneiter, George. "The ABM Treaty Today." in Aston B. Carter and David N. Schwartz. (eds) Ballistic Missile Defense. 1984.

Smith, Gerard. Double Talk. Lanham, MD. University Press of America. 1985.

_____. "Two Decades Later: The ABM Treaty in a Changed World." Arms Control Today. May 1992.

Smith, William D. "Forum on Theater Ballistic Missile Defense," hosted at the Naval Postgraduate School. Monterey, CA., 3 November 1993.

Spring, Baker. "For Strategic Defense: A New Strategy for the New Global Situation." The Heritage Foundation Backgrounder. 18 April 1991.

Starr, Barbara and John Boatman. "US Navy gets into Theater Missile Defense." International Defense Review. June 1993.

_____. "Navy TMD Waits for Funding." Jane's Defense Weekly, 12 March 1994.

_____. Interview between General Charles Horner. U.S. Space Command and Barbara Starr in Jane's Defence Weekly. 19 March 1994.

"The ABM Treaty Controversy." Congressional Digest. November 1987.

Toffler, Alvin and Heidi Toffler. War and Anti-War. Little, Brown and Company. Boston, Mass., 1993.

Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems. May 26, 1972, United States Treaties 3435. TIAS no. 7503. Government Printing Office, Washington, D.C., 1972.

U.S. Arms Control and Disarmament Agency. Arms Control and Disarmament Agreements: Texts and Histories of Negotiations. Washington, D.C., Government Printing Office, 1982.

Warnke, Paul C. "Success Linked to ABM Treaty." The Bulletin of the Atomic Scientists. November 1991.

Webster's New World Dictionary. 2nd College ed. s.v. "Base."

Weiner, Tim. "Aspin Says Inquiry Is Set On 1984 'Star Wars' Test." New York Times. 19 August, 1993.

Worden, Simon P. SDI and the Alternatives. National Defense University Press. Washington, D.C., 1991.

Zimmerman, Peter. "Key Point on ABM." Defense News. November 15, 1993.

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